AUG 2 1911


# JOURNAL OF ELECTRICITY

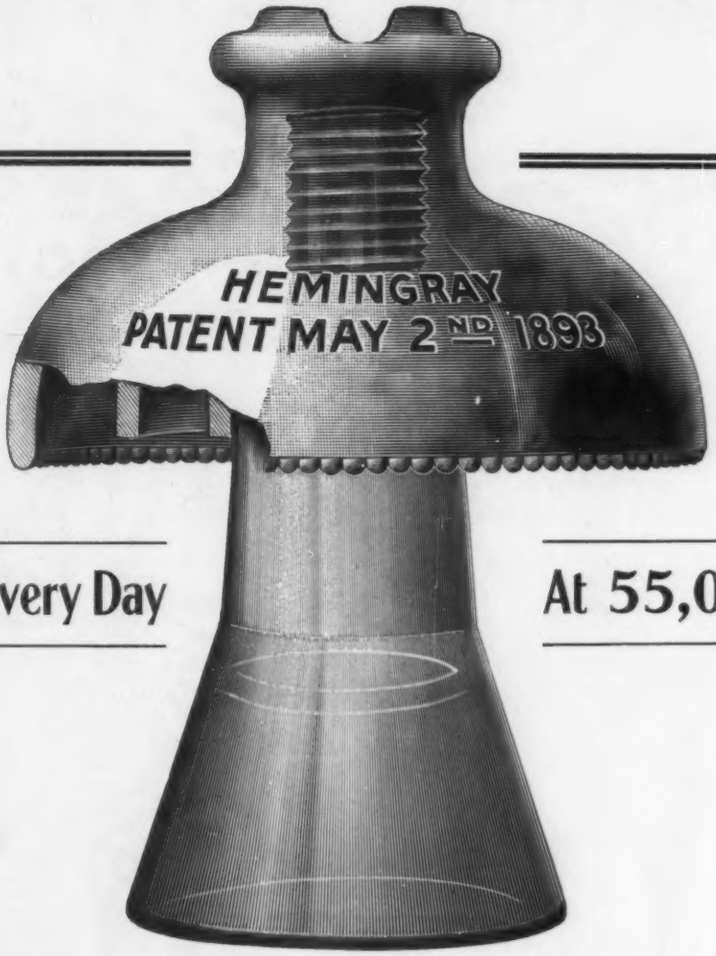
## POWER AND GAS

**Devoted to the Conversion, Transmission and Distribution of Energy**

Entered as second-class matter May 7, 1906, at the Post Office at San Francisco Cal., under the act of Congress March 3, 1879

VOL. XXVII No. 5 | SAN FRANCISCO, JULY 29, 1911 | PER COPY, 25 CENTS






Working Every Day

At 55,000 Volts

9-inch Muncie Type Insulator and Sleeve Assembled

HEMINGRAY GLASS CO.

INCORPORATED 1870

COVINGTON, KENTUCKY

REPRESENTED ON THE PACIFIC COAST BY

Electric Appliance Company, San Francisco, Calif.
Pacific States Electric Co., Los Angeles, Calif.
Fobes Supply Co., Portland, Oregon
Frank Darling & Co., Vancouver, B. C., Canada


FOR INDEX TO ADVERTISEMENTS SEE PAGE EIGHT

# $200,000,000 spent by the Southern-Union Pacific

## To Save You 4½ Hours

**This is done by improved roadbed, electric block signal protection, double tracking. New power and equipment**

**Commencing May 28, 1911**

**SAN FRANCISCO**

## "OVERLAND LIMITED"

Will leave San Francisco . . . . . 10:20 A. M.
Arrive in Chicago . . . . . 9:10 A. M.

**Connecting with All Morning Trains for New York and other eastern cities**

# Southern Pacific

**TICKET OFFICES:**

**Flood Building Palace Hotel Market Street Ferry Depot**

**TELEPHONE—KEARNY 3160**

**Broadway and 13th Street, Oakland**

# Union Pacific

**42 Powell Street**

**TELEPHONES—KEARNY 1161; HOME C-4445**

B 236062


# JOURNAL OF ELECTRICITY

## POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

VOLUME XXVII SAN FRANCISCO, JULY 29, 1911 NUMBER 5


[Copyright 1911, by Technical Publishing Company]

# CALIFORNIA CONTRACTORS CAMP AT CATALINA

The electrical contractors from all over California pitched their tents at Catalina Island during the second week of July. The northern delegation left San Francisco on July 8th, going down the coast by steamer and arriving at San Pedro on Sunday morning. Here they were met by the reception committee and escorted in special cars to the Lankershim Hotel at Los Angeles where temporary quarters were established. In the afternoon the visitors were entertained by an automobile trip along the beach resorts and through the beautiful residential section of the southern city.

Monday morning two special cars carried 150 contractors and their families to the steamer Cabrillo on which they sailed to Avalon Bay. Tents were provided for all and the joys of camp life commenced.

Picturesque Avalon—Catalina Island, where Convention was Held

After an early morning dip on Tuesday, the contractors convened in the ballroom of the Metropole Hotel with W. S. Hanbridge in the chair. Upon roll call eighty contractors qualified from San Francisco, Stockton, Sacramento, San Jose, Palo Alto, Redwood, San Mateo, San Diego, Los Angeles, Pasadena, Santa Barbara, Ventura, Pomona and Riverside. During the

F. R. Carroll, H. Davis, B. T. Griffith, N. Hope, G. Arbogast, A. P. Gaylord, L. Gans, Noble Powell, P. Levy, A. E. Ridley, H. Miller, J. S. Reynolds, W. A. McNally, F. E. Meyers, H. P. Woodill, W. S. Hanbridge, Sec'y and Treas.

afternoon the ladies of the party viewed the wonders of the sea through the glass bottomed boats, being joined late in the afternoon by the male contingent who enjoyed a moonlight boat ride. A band of minstrels furnished the music until a late hour, when the crowd returned to their tents.

On Wednesday morning the ladies enjoyed a coaching trip as the guests of one of the manufacturing companies. Meanwhile the contractors were in executive session, busy with matters of trade interest. A concert and dance furnished amusement for the evening.

The Finish of the Fat Woman's Race.

On Thursday morning, after a vigorous campaign of electioneering, officers were elected for the ensuing year. The president's chair, which had been held by W. S. Hanbridge for the last two years, was filled by the election of John Rendler of Los Angeles, both Mr. Hanbridge and Mr. Woodill declining to run. After a spirited contest Carl Heilbron of San Diego was elected first vice-president, and J. S. Reynolds of Santa Barbara second vice-president. W. S. Hanbridge was chosen to fill the duties of secretary and treasurer, which were declined by F. E. Meyers, the incumbent. R. S. Booth was elected sergeant-at-arms. New committees were appointed to take care of the matters of supply, state license, permanent by-laws and central station policy. Each committee was instructed to promote a closer working relation between the jobber, manufacturer, central station and contractor. Final adjournment of the business meetings was taken at 1 p. m.

Later in the afternoon an open meeting of the contractors and guests was addressed by S. M. Kennedy of the Southern California Edison Company who gave an instructive talk, clearing up a number of obscure points in the contracting business. Col. H. V. Carter addressed them on the cost of doing business and the ideal relations that should exist among competitors, being greeted with great applause when he had concluded. The final paper was read by Bert Fanning and covered the cost of conducting an electrical contracting business. This paper will appear later in these columns.

In the evening nearly two hundred contractors, jobbers, manufacturers, central station men and city inspectors, with their wives and sweethearts, enjoyed a fine banquet provided by genial hosts from Los Angeles and Pasadena, the dinner being followed by dancing.

On Friday morning, all business having been concluded, the entire party were taken to the Isthmus on three launches, where a big lunch was spread and a good time provided by the entertainment committee,

They Were All There—

T. Rendler, Pres. Elect | Chick Ames, H. Ross | F. Potter, G. Loveberg | D. W. Somers, E. Fleishman | Chas. Holland, O. Overholtzer | L. R. Boynton, G. Happs | R. Booth, C. Loveday | E. Shafer, F. M. Neilson | M. N. Phillips | Seth Cohn

Messrs. Booth, Gans and Fleishman. Athletic sports were the order of the day, starting with a seven-inning baseball game between the northern and southern contractors, this being won by the southerners with a score of 11-22. Chas. Holland won the prize for making

Jim and Lil Arthur in "Squared Circle."

the greatest number of runs, and Messrs. Burger and Cole acted as umpires. This was followed by a ten-inning game between the contractors and the supply men, the former winning with a score of 24-16. At the end of the first half of the ninth inning the score was 14-7 in favor of the contractors, but Manager Geo. Cole rallied his hired men so that the score was evened, but the pace subsequently proved too fast, for them, as the contractors made eight runs in the tenth inning as compared with two made by the supply men.

On the track, the 100-yard dash for members was won by Arbogast, Duncan and Potter, making second and third respectively. The 50-yard dash for ladies

The Start of the Fat Man's Race.

was captured by Mrs. Colkitt with Mrs. Miller and Mrs. Loveberg closely behind. The 100-yard dash, free-for-all, was won by Spring, Johnson second. In the 25-yard sprint for ladies of 160 lbs. or more, Mrs. Rendler came in first with Mrs. Booth and Miss McGinty second and third. The 50-yard dash for Misses was won by Miss McCain, Miss McGinty and Miss Call missing the first place. The contestants in the fat man's race, making the first three places, were Messrs.

Catalina Island, July, 1911.

Jobbers vs. Manufacturers and Supply Men Baseball Team.

Morris, Reed and Woodill. The race for boys under nine years was won by Master Beecher, with Masters Woodfill and Ames close behind. The swimming contest was won by Burger, Carroll second; the bowling by Arbogast and the wrestling by Fanning. Spring crowned his achievements and enriched his backers by almost two dollars in winning a race with the local champion.

A four round boxing contest was staged between Jim Jeffries and Jack Johnson. Johnson got the worst of it at the start, but rallied by the sympathy of the ladies Lil Arthur finally floored Jeffries, who was counted out by Referee Booth.

The prizes were awarded in the evening, most of the party retiring early to prepare for the next day's fishing. Piscatorial honors were awarded Chick Ames, Harry Sayles and Pop Boynton.

Sunday night and Monday morning found the crowd homeward bound after this most successful get-together meet of competing contractors.

Picturesque Avalon has justly gained a national reputation as a place to spend a summer's outing. The glass-bottom boats, the deep green sea beneath and the clear blue sky above present many f[illegible]ful and delightful sensations to the weary wanderer seeking rest from the cares and toils of the year. So it was that the California contractors at their camp in Avalon found their little outing most enjoyable and highly profitable in every respect. Many little side affairs were enjoyed immensely in addition to the regular program of the convention. Among one of the most enjoyable of which was the dinner given at Catalina Island during the convention by Messrs. and Mesdames Abrogast and Potter to the following starving manufacturers and jobbers' representatives: Messrs. Sayles, Herr, Steel ,Bortel and Drake.

One of the most beneficial features of such gatherings as the California Contractors at Catalina Island, is the interchange of ideas and the forging of a bond of mutual friendship and support. The friendships made in these moments of leisure are of a most lasting nature. The calling to mind of the happy times spent on such occasions makes the pathway easier and softer in the coming year's labors when contractor again meets contractor, though this time it may be in competition. Perhaps discord, strife and misunderstandings may arise, but again in the next season's meeting they will all be forgotten. There is a feeling of comradeship which naturally arises among men associated in a common vocation. This feeling is by nature of their work, by common sympathy and endeavor, of high order among those engaged in contracting. Such times as were had at Avalon, however, heighten this feeling to the highest degree and will long remain in memory among the brightest and happiest of a lifetime.

Northern vs. Southern Contractors Baseball Team.

## NEW EXPERIMENTS ON INCREASE OF WIND PRESSURE UPON SMALL WIRES.

BY F. C. PIATT, H. S. LANE AND L. A KISTLER.

In the design of an electric power transmission line there are three main forces which the structure must be designed to resist; (a) the dead weight of the wires, (b) the horizontal tension of the wires due to the flat catenaries assumed when strung, (c) the side strain due to wind force on wires and structure. Of these forces the dead weight in many cases is very small compared with the others. The horizontal tension is important in that it limits the allowable span for a given height of structure in flat country, since certain minimum ground clearances must be observed, and the sag, and therefor the span for a given height of structure, is determined by this tension. When the line is strung the pull of the wires counter-balance at each pole and creates no net pull except in case of

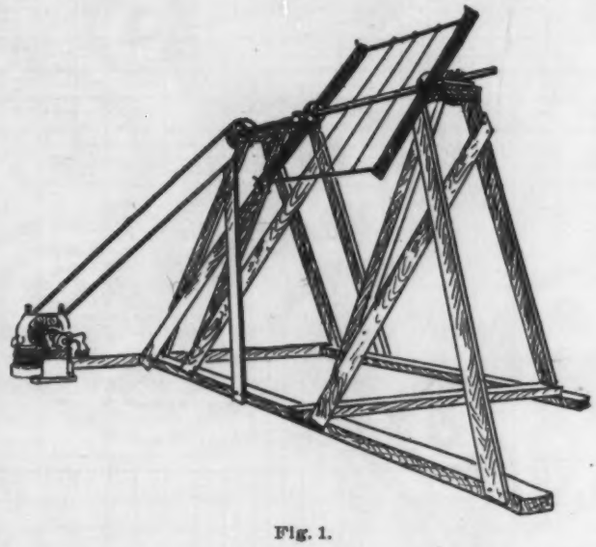


Fig. 1.

breakage of a wire, angles in the line or uneven spans. In the use of the suspension type of insulator this unevenness is automatically connected.

The wind force is, however, active on all poles or structures, and is the force which limits the allowable length of span in hilly country. Deep valleys may permit the use of very long spans so far as weight or horizontal tension are concerned, whereas the possible wind forces acting on the wire may cause greater stresses in wire or structure than are allowable.

These wind forces have usually been calculated in accordance with the rule given by Prof. Kernot, who states (in the Engineering Record of Feb. 20, 1894) that the pressure due to wind on cylinders (wires) is one-half that on flat plates of equal areas. This rule has been very generally followed; for example, by F. O. Blackwell in a paper on "Long Spans for Transmission Lines" presented before the A. I. E. E. June 21, 1904. Following this rule a pressure of 20 lbs. per sq. ft. of exposed area of wire has been widely adopted, corresponding to a pressure on flat surfaces of 40 lbs. per sq. ft., which is given as the wind pressure at a wind velocity of 100 miles per hour.

It seemed very doubtful to the authors of this series of tests that the pressure on wires would be independent of diameter as indicated by Kernot's rule. Apparatus was therefore arranged to actually measure the forces acting on wires of ordinary commercial sizes when exposed to winds of definite velocities. Enough wires were to be tested to find the variation of wind force with wire diameter, if it existed. Cables were also to be tested, as it seemed probable that they would give results differing from solid wires of the same diameter.

The apparatus used is shown in Fig. 1. The general arrangement is so clearly shown that explanations seem unnecessary. The principal dimensions are as follows:

| | |
|---|---|
| Height of shaft from ground | 5 ft. 6 in. |
| Clear distance between arms | 4 ft. 0 in. |
| Length of arms | 4 ft. 2 1/16 in. |
| Radius of Arms to holes bored for wires | 2 ft. 0 in. |
| Width of arms | 2 9/16 in. |
| Thickness of arms | ¾ in. |

Two precisely similar pieces of wire were mounted between the arms, parallel with the shaft, as indicated in the photograph. The wires, being placed as far as possible from the axis, and rotating in a cylindrical surface, were in a position to show their maximum wind effect. The shaft was belted to the motor and speeded up until the tangential velocity of the wires was about 120 miles per hour, when the belt was thrown off and the apparatus slowed down under the influence of friction and windage.

Deceleration curves were obtained by means of the tachometer attached to the machine and a chronograph, the observer closing the chronograph circuit at the instant the tachometer needle indicated 800, 750, 700, etc., r.p.m., thus obtaining a speed time record on the chronograph tape. Runs were made with the test wires in place, and without them ("Zero Runs"), thus allowing the effect of the test wires to be separated from that of the rest of the apparatus.

Owing to the severe normal forces acting on the wires when in rotation it was necessary to tie them in to the shaft at intervals along their length with tie wires. During the "Zero Runs" these tie wires were kept in place by means of fine piano wires mounted in place of the test wires. Due allowance was made for these piano wires by means of a separate run using additional wires of the same kind outside the "Zero Run" wires.

Various sizes of wire were thus tested, and also three samples of cable, the cable being that used by the Great Western Power Company for ground wire (lightning arrester), for ordinary spans, and for river crossings (Monott cable).

The following notation is used throughout this article:

P = force, lbs. weight.
N = revolutions per minute.
W = weight in lbs.
V = angular velocity, radius per second.
T = time, seconds.
I = moment of inertia about the axis of rotation.
h = lever arm, feet.
$\omega$ = angular velocity (radians per sec.)
K = A constant for any one wire.

In general from the study of mechanics we learn—

$$Ph = I \frac{d\omega}{dt}$$

$$\text{but } \omega = \frac{2\pi N}{60} \quad \therefore \quad d\omega = 2\frac{\pi}{60} d N$$

And therefore, in general

$$Ph = \frac{2\pi}{60} I \frac{d N}{d t}$$

In our calculation we found — by a method equivalent to a graphical differentiation of the curve $\frac{d N}{dt}$ $N = f(t)$.

That is, we measured dt between successive 50 r.p.m. readings on the chronograph tape, and considered this d t applied to the mean r.p.m. of the interval. These values are given in Table 1 for No. 0000 copper wire and in Table II for No. 19 B. W. G. That is,

TABLE I.

| Run. | 1 Zero | | 2 Zero | | 3 No. 0000 | | 4 No. 0000 | |
|---|---|---|---|---|---|---|---|---|
| N | t | dt | t | dt | t | dt | t | dt |
| 800 | .46 | | .10 | | | | .54 | |
| | | 1.27 | | 1.32 | | | | .65 |
| 750 | 1.73 | | 1.42 | | | | 1.19 | |
| | | 1.27 | | 1.26 | | | | .63 |
| 700 | 3.00 | | 2.68 | | .29 | | 1.82 | |
| | | 1.47 | | 1.32 | | .89 | | .66 |
| 650 | 4.47 | | 4.00 | | 1.18 | | 2.48 | |
| | | 1.62 | | 2.00 | | .82 | | .92 |
| 600 | 6.09 | | 6.00 | | 2.00 | | 3.40 | |
| | | 1.91 | | 2.00 | | 1.00 | | 1.10 |
| 550 | 8.00 | | 8.00 | | 3.00 | | 4.50 | |
| | | 2.27 | | 2.00 | | 1.20 | | 1.01 |
| 500 | 10.27 | | 10.00 | | 4.20 | | 5.51 | |
| | | 3.23 | | 3.00 | | 1.45 | | 1.63 |
| 450 | 13.50 | | 13.00 | | 5.65 | | 7.14 | |
| | | 3.32 | | 3.68 | | 2.20 | | 2.00 |
| 400 | 16.82 | | 16.68 | | 7.85 | | 9.14 | |
| | | 4.93 | | 4.62 | | 2.38 | | 2.51 |
| 350 | 21.75 | | 21.30 | | 10.23 | | 11.65 | |
| | | 6.25 | | 6.40 | | 3.47 | | 3.45 |
| 300 | 28.00 | | 27.70 | | 13.70 | | 15.10 | |
| | | 8.29 | | 8.30 | | 4.74 | | 4.55 |
| 250 | 36.29 | | 36.00 | | 18.44 | | 19.65 | |
| | | 11.71 | | 11.60 | | 6.86 | | 6.92 |
| 200 | 48.00 | | 47.60 | | 25.30 | | 26.57 | |
| | | 16.20 | | 17.40 | | 12.10 | | 11.43 |
| 150 | 64.20 | | 65.00 | | 37.40 | | 38.00 | |

TABLE II.

| Run | 32 Zero | | 34 No. 19 B.W.G. | | 35 No. 19 B.W.G. | |
|---|---|---|---|---|---|---|
| N | t | dt | t | dt | t | dt |
| 800 | .26 | | .40 | | .69 | |
| | | 1.34 | | .60 | | .92 |
| 750 | 1.60 | | 1.00 | | 1.61 | |
| | | 1.11 | | 1.14 | | 1.23 |
| 700 | 2.71 | | 2.14 | | 2.84 | |
| | | 1.54 | | 1.41 | | 1.16 |
| 650 | 4.25 | | 3.55 | | 4.00 | |
| | | 1.62 | | 1.36 | | 1.61 |
| 600 | 5.87 | | 4.91 | | 5.61 | |
| | | 2.30 | | 1.83 | | 2.04 |
| 550 | 8.17 | | 6.74 | | 7.65 | |
| | | 2.54 | | 2.16 | | 1.95 |
| 500 | 10.71 | | 8.90 | | 9.60 | |
| | | 3.07 | | 2.78 | | 2.89 |
| 450 | 13.78 | | 11.68 | | 12.49 | |
| | | 3.61 | | 3.32 | | 3.21 |
| 400 | 17.39 | | 15.00 | | 15.70 | |
| | | 5.01 | | 4.35 | | 4.30 |
| 350 | 22.40 | | 19.35 | | 20.00 | |
| | | 6.75 | | 5.65 | | 5.40 |
| 300 | 29.15 | | 25.00 | | 25.40 | |
| | | 9.85 | | 7.53 | | 7.94 |
| 250 | 39.00 | | 32.53 | | 33.34 | |
| | | 13.51 | | 11.07 | | 11.59 |
| 200 | 52.51 | | 43.60 | | 44.93 | |
| | | 20.31 | | 17.80 | | 18.47 |
| 150 | 72.82 | | 61.40 | | 63.40 | |

d N = 50 was varied at intervals throughout the work (the tachometer readings were correct at all speeds), and dt at any speed was taken from the curves, plotted from the data so compiled. Fig. 2 and 3 show the curves for No. 0000 wire and No. 19 B. W. G. Let

$I_o$ = moment of inertia of apparatus including tie and "zero" wires.

Iw = moment of inertia of wires.

I = moment of inertia with test wires.

Then the force moment for the "Zero Runs"

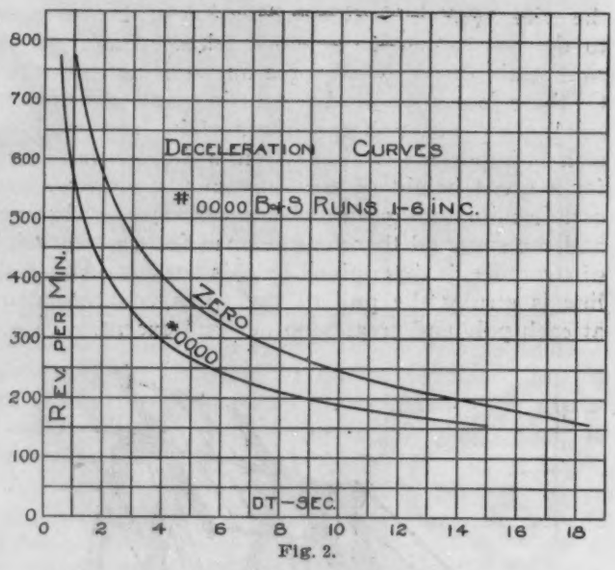


Fig. 2.

$$Poho = \frac{2\pi}{60} I_o \frac{d N}{d t_o} = \frac{K_o}{d t_o}$$

For the test runs

$$Ph = \frac{2\pi}{60} I \frac{d N}{d t} = \frac{K}{d t}$$

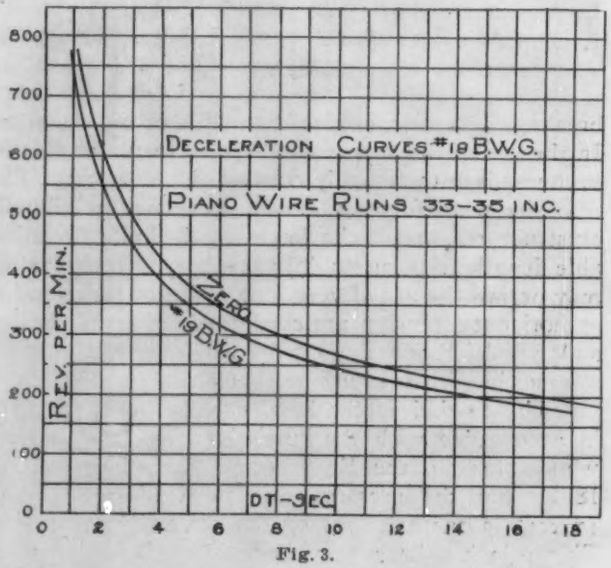


Fig. 3.

I was found by weighing each part of the apparatus and from its dimensions computing its moment of inertia about the axis of rotation.

We neglected the moment of inertia of the wire about its own axis in figuring $I_w$, that is $I_w = \frac{wh^2}{g}$

The moments of inertia are tabulated below:

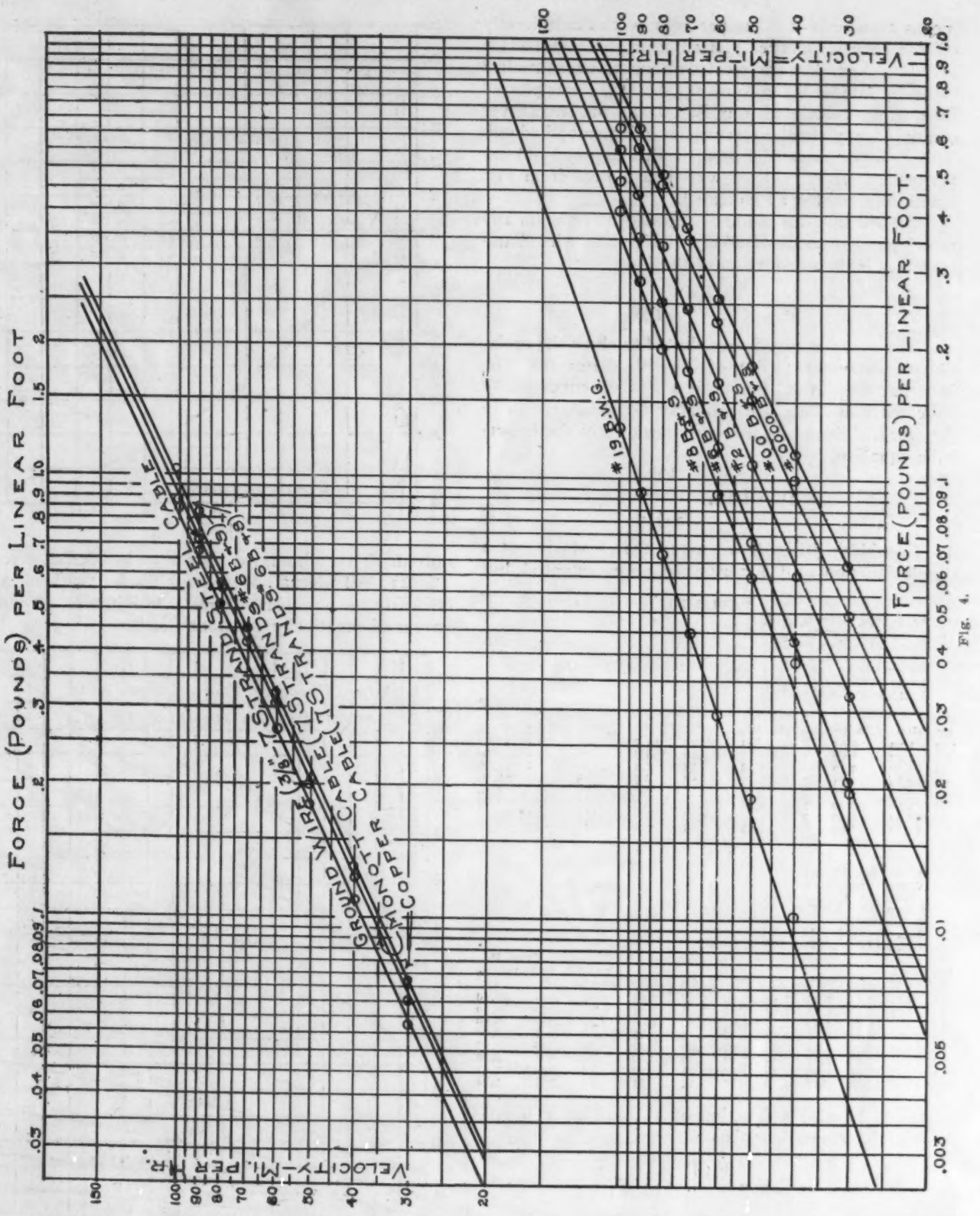



Fig. 4.

| Member | Weight | Formula | Moment of Inertia |
|---|---|---|---|
| 2 arms | 53.55 | $M\left(\frac{h^2}{3}+\frac{a^2}{12}\right)$ | 2.422 |
| Shaft | 39.26 | $M\frac{r^2}{2}$ | .001654 |
| Collars | 2.38 | $\frac{M}{2}\left(r_1^2-r_2^2\right)$ | .000225 |
| Flange No. 1 | 3.75 | $\frac{M}{2}\left(r_1^2-r_2^2\right)$ | .00284 |

The run for No. 0000 wire made with pulley No. 1, while that for No. 19 B. W. G. with pulley No. 2. For the two cases respectively

$I_o = 2.463 +$ mom. of "Zero wires."
$I_o = 2.484 +$ mom. of "Zero wires."

All the calculations are arranged in the tables, which are self-explanatory.

Calculations based on the deceleration curves are shown for No. 0000 wire in Table III, and for No. 19 B. W. G. wire in Table IV. Values of dt correspond-

ing to even tens of miles per hour were read directly off the curves. Curves plotted from these tables are given in Fig. 4 were plotted from values (marked "true" in tables) taken from Fig. 4. Fig. 7 was plotted from values calculated from Fig. 6, and the two curves compared, any small discrepancies being smoothed out. This process, as can be seen, tended to weed out experimental errors. Fig. 8 was then plotted from Fig. 6 and exterpolated as indicated.

An attempt was made to express the force on any round wire in terms of wind velocity and wire diameter, that is, in an equation of the form

$$P = KV^{\frac{f(d)}{F(d)}}$$

The curve in Fig. 5 was plotted to show the variation of exponent (f(d)) of V with diameter. The fact that the plotted points fit a smooth curve nicely indicates that there are probably no gross errors in the work. The curve fits quite accurately the hyperbolic equation.

$$f(d) = 1.55 + \frac{.405}{.25 + d}$$

Considering Fig. 8 we found that F(d) is not a simple function of d, for instance, an exponential, but

TABLE III.

Wire, No. 0000 B. & S.
Weight = 5.22 lb.
Mean diam. = .460 in.
Mean h = 2.0118 ft.
Iw = .660.
Io = 2.463 + .004 = 2.467.
I = 2.463 + .660 = 3.123.

| Mi. hr | dto | Net Po ho | Net Po ho | dt | Ph | Net Ph | P per lin. ft Obs. | P per lin. ft True | True P per sq ft |
|---|---|---|---|---|---|---|---|---|---|
| 100 | 1.29 | 10.04 | 8.04 | .69 | 23.72 | 11.68 | .725 | .760 | 19.80 |
| 90 | 1.62 | 7.99 | 6.47 | .84 | 19.49 | 9.98 | .620 | .610 | 15.90 |
| 80 | 2.09 | 6.19 | 5.07 | 1.08 | 15.16 | 7.85 | .487 | .475 | 12.40 |
| 70 | 2.75 | 4.71 | 3.93 | 1.42 | 11.52 | 6.03 | .375 | .360 | 9.40 |
| 60 | 3.70 | 3.50 | 2.98 | 2.01 | 8.14 | 4.12 | .256 | .262 | 6.86 |
| 50 | 5.20 | 2.49 | 2.16 | 2.90 | 5.64 | 2.82 | .175 | .180 | 4.70 |
| 40 | 7.94 | 1.63 | 1.45 | 4.44 | 3.68 | 1.87 | .116 | .114 | 2.98 |
| 30 | 13.00 | 1.00 | .92 | 7.95 | 2.06 | .98 | .061 | .062 | 1.62 |

TABLE IV.

Wire, No. 19 B.W.G.
Weight = .034 lb.
Mean diam. = .040 in.
Mean h = 2.138 ft.
Iw = .0048.
Io = 2.484 + .004 = 2.488.
I = 2.484 + .004 + .005 = 2.493.

| Mi. hr | N | dto | Po ho | dt | Ph | Obs. net Ph at mean h | True net Ph at 2.0 ft | True net Ph at 2 ft | True P per ft | True P per sq ft |
|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 655 | 1.64 | 7.95 | 1.29 | 10.12 | 2.17 | 2.03 | 2.04 | .128 | 38.40 |
| 90 | 589 | 2.10 | 6.21 | 1.66 | 7.86 | 1.65 | 1.54 | 1.51 | .094 | 28.20 |
| 80 | 524 | 2.67 | 4.98 | 2.17 | 6.01 | 1.13 | 1.06 | 1.06 | .066 | 19.80 |
| 70 | 459 | 3.46 | 3.77 | 2.89 | 4.55 | .78 | .73 | .72 | .045 | 13.50 |
| 60 | 393 | 4.60 | 2.83 | 3.92 | 3.33 | .50 | .47 | .46 | .029 | 8.70 |
| 50 | 328 | 8.62 | 1.97 | 5.45 | 2.40 | .43 | .40 | .27 | .017 | 5.10 |
| 40 | 262 | 10.40 | 1.25 | 8.35 | 1.56 | .31 | .29 | .14 | .0089 | 2.67 |
| 30 | 197 | 17.00 | .767 | 14.70 | 8.88 | .12 | .11 | .06 | .0038 | 1.14 |

seems to be also a function of V, practically impossible of determination; that is

$$P = KV^{\frac{F(d)}{F(d, V)}}$$

This equation, even if it could be evaluated, is much too complicated and uncertain to be of much practical value. The important results of the work are shown in Figs. 6, 7, 8 and 9. To give an idea of the accuracy to be expected from the results the following details of precautions taken are given:

(1) Two successive runs were made with each wire tested, with a "Zero run" before and after these test runs, the average of the test and Zero runs being

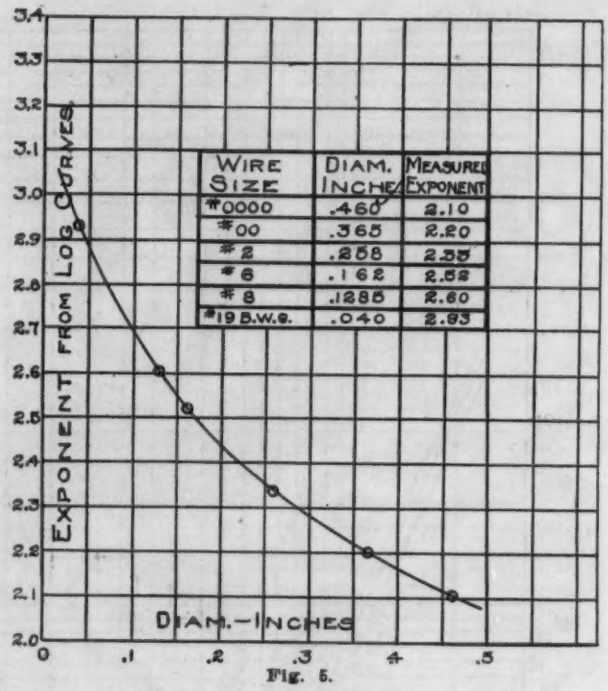
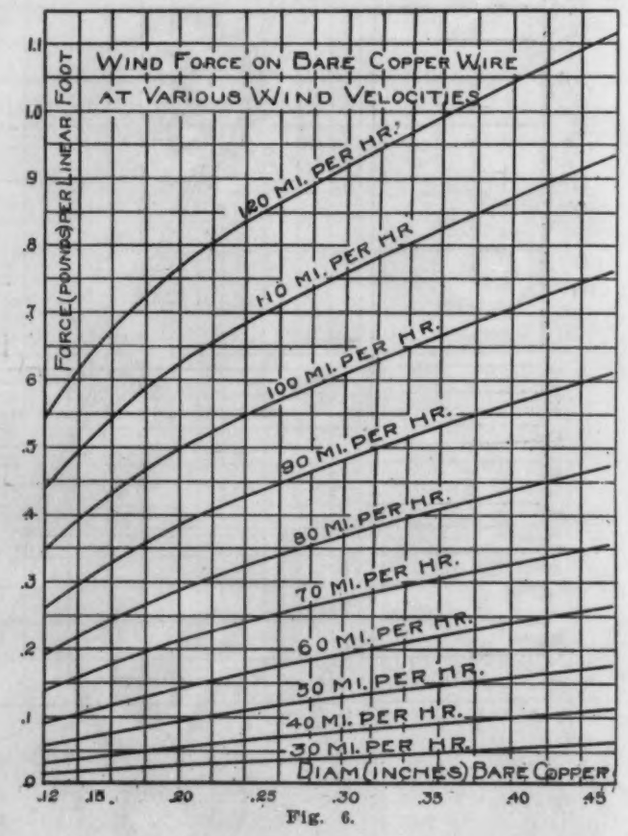


Fig. 5.

plotted. This eliminated chance of accidental errors.

(2) All journals were kept flooded with oil and as nearly as possible of constant tightness, to make certain of practically constant friction.

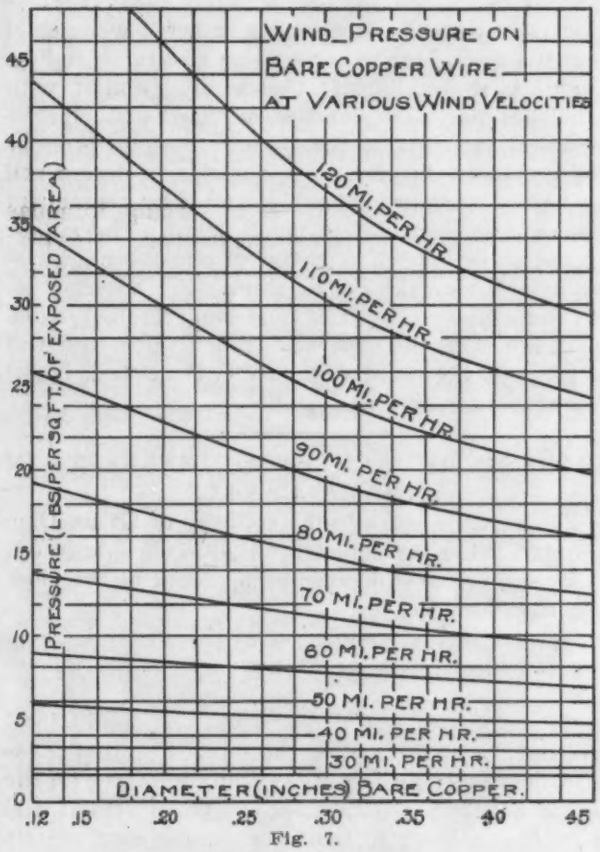

WIND FORCE ON BARE COPPER WIRE
AT VARIOUS WIND VELOCITIES
FORCE (POUNDS) PER LINEAR FOOT
120 MI. PER HR.
110 MI. PER HR.
100 MI. PER HR.
90 MI. PER HR.
80 MI. PER HR.
70 MI. PER HR.
60 MI. PER HR.
50 MI. PER HR.
40 MI. PER HR.
30 MI. PER HR.
DIAM (INCHES) BARE COPPER
Fig. 6.

(3) The tachometer was calibrated with its pulley which was turned up to make the tachometer read correctly. The tachometer was correct at all speeds.

(4) One person made all chronograph records, in order to avoid changing the personal equation, and

to take advantage of expertness acquired in reading tachometer.

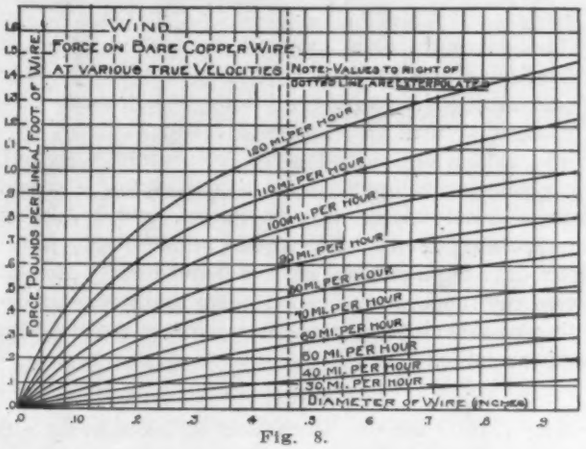
(5) It was thought that there might be some pumping effect on the air due to the wires. To determine this smoke was blown in, and also fine sawdust thrown in, while the apparatus was in rotation. From this it was found that inside the path of the wires the air had almost no motion until within one or two inches of the path of the rotating wires. From this point the velocity of the air increased rapidly towards the wires and then diminished again outside the wires. An anemometer was then placed outside the path of the wires and the wind velocity measured at various distances from the wires, for several speeds of rotation. These measurements showed that the wind velocity increased more and more rapidly as the wire was approached and seemed to show that the velocity of the air equaled that of the wire at the surface of the wire.


WIND—PRESSURE ON BARE COPPER WIRE AT VARIOUS WIND VELOCITIES
PRESSURE (LBS. PER SQ. FT. OF EXPOSED AREA)
120 MI. PER HR.
110 MI. PER HR.
100 MI. PER HR.
90 MI. PER HR.
80 MI. PER HR.
70 MI. PER HR.
60 MI. PER HR.
50 MI. PER HR.
40 MI. PER HR.
30 MI. PER HR.
DIAMETER (INCHES) BARE COPPER.
Fig. 7.

This state of affairs was to be expected, and corresponds exactly with what is called the "cushion effect" of stationary wires. In either case the relative velocity of wind and wire is probably zero at the surface of the wire, but increases very rapidly with the distance from the wire. It was assumed that the relative velocity curve for a stationary wire and moving air would be the same as that for stationary air and a moving wire, and hence no correction was attempted for this effect.

Another indication that "pumping" was not an important factor is the fact that the pressure per square foot increased with decrease of wire diameter, whereas had pumping played any important part its effect would be to show greater pressure per square foot on the larger wires.

(6) Under the influence of the normal force ($Mh\omega^2$) the wires formed approximate flat catenaries between the points of attachment of tie wires and arms, so that the distance (h) from center of shaft


WIND FORCE ON BARE COPPER WIRE AT VARIOUS TRUE VELOCITIES
NOTE—VALUES TO RIGHT OF DOTTED LINE ARE INTERPOLATED
FORCE POUNDS PER LINEAL FOOT OF WIRE
120 MI. PER HOUR
110 MI. PER HOUR
100 MI. PER HOUR
90 MI. PER HOUR
80 MI. PER HOUR
70 MI. PER HOUR
60 MI. PER HOUR
50 MI. PER HOUR
40 MI. PER HOUR
30 MI. PER HOUR
DIAMETER OF WIRE (INCHES)
Fig. 8.

to center of wire was not exactly uniform. The wires retained this distorted form permanently, and the mean distance was computed from eighteen measurements at equidistant points along the shaft, the tie wires being meanwhile held taut. The algebraic mean of these measurements was used, and is certainly good to within 0.5 per cent or better.

(7) Since the apparatus as constructed formed a closed circuit electrically, which was rotated at high speed in the earth's magnetic field, it was considered possible, in view of the extremely low resistance of the circuit, that some energy might have been used in $I^2R$ loss due to the induced current, thereby increasing the apparent wind effect. This effect was therefore calculated as follows:

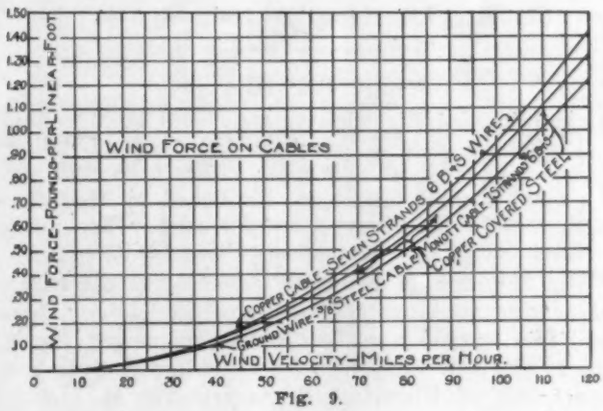
Assumptions:

Neglect contact resistances.

Speed 800 r.p.m.

Consider No. 0000 copper in the machine.

Total intensity of earth's magnetic field .60 lines per sq. cm.


WIND FORCE ON CABLES
WIND FORCE—POUNDS-PER-LINEAR-FOOT
COPPER CABLE—SEVEN STRANDS, 8 B.&S. WIRES
GROUND WIRE—3/8 STEEL CABLE
MONITOR CABLE 7 STRANDS COPPER COVERED STEEL
WIND VELOCITY—MILES PER HOUR.
Fig. 9.

Closed circuit consisted of two wires (No. 0000) and two steel arms each 4 ft. long.

Total resistance $6.17 \times 10^{-4}$ ohms.

$$I \max = \frac{(\text{Area}) \times (\text{Field Intensity}) \times \omega}{(\text{Res.}) \times 10^8}$$

$$= \frac{(4 \times 12 \times 2.54)^2 \times .6 \times 83.7}{6.17 \times 10^{-4} \times 10^8} = 12.15 \text{ Amperes.}$$

I effective = 8.59 amperes.

$\therefore I^2 R = .0456$ watts = .0336 ft. lbs. per sec.

This gives the total moment due to this effect of .000396 lb. ft., which is entirely negligible, the windage moment under the same conditions being about 24.0 lb. ft., as shown in the Tables III and IV.

(8) All wires tested were accurately weighed, wire tables not being used for this data. The round wires accurately fitted a wire gauge, hence tabular diameters were used. The stranded cables were measured by drawing a narrow strip of paper tightly around the circumference of the cable. The diameter corresponding to this circumference is called the mean diameter of the cable.

### Results.

The results of the work are so completely expressed by the curves as to need little comment.

From the account of the precautions taken and from a scrutiny of the tables and curves the reader can form his own opinion as to the reliability of the results. In the opinion of the authors they may be depended upon to within ten per cent.

The curves show that the common assumption of a wind pressure of 20 lbs. per sq. ft. of exposed area corresponding to a wind velocity of 100 miles per hour is closely correct for No. 0000 solid copper, but that the pressure on smaller sizes is considerably greater, reaching about 35 lbs. per sq. ft. on No. 8 wire. This increase of pressure for small wires is an important result, and helps to explain the difficulties commonly experienced with telephone lines when long spans are attempted.

As can be seen by an inspection of the curves cables have from 15 to 25 per cent greater pressure per square foot than solid wires of the same mean diameter. This was of course to be expected.

In conclusion the authors desire to express their thanks to Prof. J. N. Le Conte for valuable suggestions, and to Mr. J. H. Piatt of the Great Western Power Company for suggestions and materials.

## BOOK REVIEW.

**Practical Applied Electricity.** By David P. Moreton. Pocket size, 4½x7¼ inches ;450 pages; 273 line drawings and 50 halftones; clear type; strong paper; durable bindings. Published by Reilly & Britton Co., of Chicago, and for sale by Technical Book Shop, San Francisco. Price $2.00.

Mr. Moreton as Associate Professor of Electrical Engineering at Armour Institute of Technology, has based this text, to a certain extent, upon a series of lectures given by himself in his evening classes in the Department of Electrical Engineering at the Institute. His explanation of the fundamental principles of the subject is so clear and so simple the book is heartily commended to all those interested in teaching in the High and Manual Training Schools and can be most profitably kept as a reference book for all those engaged in the electrical trade who have been denied the privilege of university training in electrical engineering.

The convenient size and flexible covering commends its use to that great class of ambitious young men who are obliged to work many hours of the day but are ready to learn at every opportunity, even if presented while riding to and from their daily work.

Twenty pages are devoted to the index, thus making the text readily accessible for reference. As the book is just from the press it contains many new ideas and descriptions. The chapter on lighting is especially complete in this regard, giving a description of the many new lamps which have recently come into use.

**Three-Phase Transmission.** By William Brew, M. I. E. E. Size 5½x8½ inches; 178 pages; 82 illustrations. Published by D. Van Nostrand Company of New York, and for sale by Technical Book Shop, San Francisco. Price $2.00.

Replete with the experiences gathered while chief expert assistant, Dublin corporation electricity supply, the author shows himself thoroughly familiar with English practice. The question of higher mathematics is ignored throughout the book, working formulas being presented directly. The question of design and operation of underground cables and their consequent phenomena is discussed in much detail. The author does not show himself a master of our overhead systems in vogue on the Pacific slope. For a deeper insight into foreign practice and underground cable design, however, the book is of much value, and will add its portion toward rounding out the desk books of the modern engineer.

## PROGRESS AND INTENSE INTEREST IN PANAMA CANAL.

The concrete work in the spillway of Gatun Dam is about 63 per cent completed, 141,493 cubic yards, out of a total of 225,000, having been placed at the close of work on June 24.

Interest in the completion of the Panama Canal is world-wide. From far-off Suva comes the following:

"If you glance at a map you will see," said a local enthusiast, "that Suva is on the direct line from Sydney to the canal. In fact it is exactly a quarter of the distance between Australia's commercial capital and the Pacific entrance to the canal. Supposing vessels maintaining a speed at sea of 15 knots per hour are employed, the trans-Pacific run will occupy 18½ days. Give a day for navigating the Isthmus, and 10 days on to London. This will show a saving of about a week over the present all-sea mail route to London via Colombo. Suva will be the last port of call from Sydney and the first port of call from Panama. Already land is rapidly advancing in price there, and any amount of capital is ready in Sydney to erect at Suva elaborate hotels, such as Colombo possesses. I was given to understand that the Royal Mail Steam Packet Company is already at work on plans for a first-class passenger service from Southampton to Sydney, via the Panama Canal. This corporation is simply biding its time to enter the Australian trade aagin."

## THE ELECTRICAL SECTION OF THE BUREAU OF MINES, ITS PURPOSE AND SOME FRUITFUL RESULTS.

In a recent technical paper published by the Bureau of Mines announcement is made of the establishment of the electrical section of the Bureau. The following interesting features are set forth as calling for its establishment:

Electricity is used underground in mines for haulage, lighting, driving pumps, fans, drills, coal-cutting machines, and hoists, for detonating explosives, and for signaling. Both direct current and alternating current are used, the former much more extensively than the latter. Direct current is distributed at potentials up to 600 volts wherever power is used. Alternating current is distributed at over 2000 volts and is usually carried only a short distance underground to serve high-voltage motors or transformers operating motor-generator sets or rotary converters.

Electric haulage is operated principally from trolley wires at 250 or 500 volts. The trolley wire is necessarily bare, and in low coal is dangerously near the heads of persons in the same entry with it. Lighting circuits are often connected between the trolley wire and earth, with the lamps in series. Stationery motors are often connected between the trolley wire and earth. Machine wires are frequently bare up to the point of connection with the trailing cables.

Explosives are detonated from batteries (storage or primary), from magneto generators (frequently refered to as batteries), from power circuits, and from separate generators used only for detonating. Signals, which include lights, bells, and telephones, are operated principally from primary batteries.

Underground equipment is exposed to falls of roof, coal and rock, that are sufficient to wreck installations of the best character. The acid waters and the dampness in mines make the insulation problem difficult. The fact that the need of electric service at many points underground is only temporary limits economical investment in equipment. The problem of safeguarding life is rendered still more difficult by the fact that many of the underground workers do not appreciate the dangerous character of electricity and ignore the rules made for their protection. The temptation to install electrical equipment in coal mines in a temporary and improper manner is increased by the fact that coal, especially dry coal, is not a good conductor of electricity, and wires may sometimes come in contact with the coal without trouble resulting. A machine wire supported upon wooden pegs driven into the coal may never give trouble; and it would be hard to convince a man whose only experience had been with such installations that to thus support a wire is not good practice. In this connection it is probable that electrical practice in mines would be generally improved if more of the mine electricians were familiar with the best installation methods.

The three principal dangers connected with the use of electrical equipment in mines are as follows: The danger from electric shock, the danger from explosions caused by electricity, and the danger from fire started by electricity. The chief sources of danger from shock are the trolley wire and other bare conductors. Another source is ungrounded equipment that has become charged with electricity through defective insulation or otherwise.

The danger from electrical explosions arises from the occurrence of sparks and arcs in inflammable gas or dust. Sparks of sufficient size to ignite gas may be produced when a motor is started rapidly or operated under heavy load, when a circuit carrying current is opened, or when a circuit becomes grounded. A much larger spark is required to ignite bituminous coal dust, but such dust might be ignited by the opening of a circuit carrying a large current, or by flashes produced by heavy short circuits. The fall of a trolley wire might give both of these conditions. The danger from fire arises from grounds to coal or in the vicinity of inflammable material, from the flashing of motors under the latter condition, from short circuits, and the burning off of wires carrying heavy currents. Besides the above-mentioned dangers, the handling of explosives in the vicinity of electricity and the detonation of them by electric means give rise to others.

The practical solution of the problem of safeguarding the use of electricity in mines will require the adoption of protective measures and of devices that are simple, rugged, "fool proof," and as inexpensive as possible. At the same time both measures and devices must be entirely effective or they will become a menace. Although it will be necessary to investigate many possible causes of electrical dangers, some are already well known, and the desirability of protection against them is apparent.

There is a field for devices for reducing the danger of shock from the trolley wire and for devices for preventing the ignition of gas by motors, switches, and other circuit-opening apparatus. There is a field for an acid-proof material for insulating wires and cables, and there is room for improvement in the methods of installing electrical equipment underground. The improvement of electrical conditions underground will doubtless be a gradual development, as has been the case aboveground, where advancement in electrical practice has been continuous for many years.

Most mine operators, if not all of them, would be willing to install safer electrical equipment if the market could supply it. Manufacturers are willing to develop especially safeguarded equipment as fast as they see a field for its use. Some of the manufacturers of this country are now developing motors and switches designed to be explosion proof, and the Bureau of Mines has always found manufacturers of electrical apparatus ready to co-operate in its electrical investigations.

The bureau has made a few preliminary investigations, the most important of which are an investigation as to the danger of gas ignition by the indicators of inclosed fuses, and an investigation as to the danger of gas ignition by incandescent lamps when broken in gaseous atmospheres. The former is reported in detail in this circular; the latter is being continued, and a final report will be made after the completion of more elaborate tests.

### Incandescent Lamp Tests.

The preliminary investigation showed that certain sizes of incandescent lamps, when broken, ignite surrounding explosive mixtures of gas and air. The tests now under way will determine the factor of safety of such lamps as have not caused ignition in previous experiments.

In making tests of incandescent lamps they are placed in a gas-tight receptacle filled with a mixture of gas and air combined in proportions most sensitive to ignition. The lamps are lighted and the filaments are brought into contact with the gaseous mixture in three ways, as follows:

(a) By smashing the bulbs completely, which brings the mixture in contact with broken filaments.

(b) By snipping off the tips, which usually does not break the filaments as the velocity of the entering gas is less than in (a).

(c) By puncturing a small hole in the necks of the bulbs, which prevents the entering gas from impinging directly upon the filaments and therefore rarely breaks them.

Such lamps as do not ignite the mixtures under normal conditions are further tested by increasing the temperature of their filaments until explosion follows the breaking of the lamps. A comparison of the excess energy required in any case gives a good indication of the relative safety of the lamp.

In addition to making these lamp tests, the bureau is investigating explosion-proof motors, explosion-proof switches, and the action of mine water upon the insulation of electric conductors.

### Tests of Explosion-Proof Apparatus.

Explosion-proof switches and explosion-proof motors are tested in the same way, as the flame-proof quality of the casings is in each case the point at issue.

The term "explosion-proof," as applied by the Bureau of Mines to electrical equipment, refers to apparatus inclosed in casings that are so designed and constructed that the products of explosion resulting from the ignition, within the casing, of any mixture of methane and air will be either entirely confined within the casing or so discharged from it that they can not ignite a mixture of methane and air, combined in proportions most sensitive to ignition, entirely surrounding the casing and in intimate contact therewith.

In testing explosion-proof apparatus the casings are completely filled with various mixtures of gas and air and completely surrounded by a mixture of the same constituents combined in proportions most sensitive to ignition. The mixture within the casing is exploded by an electric spark, and the character and extent of the discharged flames, and their action upon the surrounding gas are noted.

Means are provided for measuring the pressure developed within the casings by the explosions.

### Tests of Insulation of Electrical Conductors.

The present investigation of the action of acid mine waters upon the insulation of electrical conductors is preliminary in character, having for its purpose the standardization of methods for future tests. The results of this investigation will determine the character of the waters to be used, the best way to apply them to the insulation, and the most satisfactory methods of observing the action of the water upon the material under test.

In the present test two kinds of water are being used. These are being applied in three different ways to three different kinds of insulations, of each of which there are 10 samples 50 feet in length. The action of the water upon the insulation is being observed by means of insulation resistance measurements and by high potential tests.

### Other Investigations.

Preparations are now being made to investigate the action of electric sparks and arcs in coal dust.

Among other investigations to be undertaken as soon as possible are an investigation of the danger of using electricity in the vicinity of explosives, an investigation of electrical shot-firing devices, and a study of devices for the protection of the trolley wire.

### Tests of Inclosed Cartridge Fuses in Explosive Gas.

As a part of the investigation of the causes of mine explosions, authorized by Congress in May, 1908, the Secretary of the Interior decided that a careful examination should be made of the various inclosed electric fuses used in mining operations with a view to determining how far these fuses, when installed for service in gaseous atmospheres, might be responsible for the occurrence of disasters.

The fuses tested were standard N. E. C. cartridge fuses of the indicator type, varying in size from 30 amperes, 250 volts, to 100 amperes, 600 volts.

There are two elements of danger attending the action of such fuses in the presence of inflammable mixtures of gas and air, namely: (a) The action of the indicators located on the external surface of the shell; these when the fuse acts may, by giving out sparks or otherwise, ignite the explosive mixture; (b) the blowing of hot gas and jets of flame through the relief ports of the fuses by the energy released within the shell.

The results of the tests are summarized in the following table:

RESULTS OF TESTS OF INCLOSED CARTRIDGE FUSES.

| Brand No. | No. of tests | No. of explosions | Cause of explosion. Undetermined | Indicator | Blowing at port | Percentages of explosions |
|---|---|---|---|---|---|---|
| 1 | 24 | 10 | 1 | 3 | 6 | 41.6 |
| 2 | 23 | 12 | .. | 12 | .. | 52.2 |
| 3 | 32 | 24 | .. | 24 | .. | 75.0 |
| 4 | 24 | 5 | .. | 5 | .. | 20.8 |
| 5 | 20 | 13 | .. | 13 | .. | 65.0 |
| 6 | 21 | 1 | .. | .. | 1 | 4.75 |
| 7 | 32 | 1 | .. | 1 | .. | 3.125 |

### Conclusions.

The conclusions obtained from the results of these tests are as follows:

1. One or more sizes of all the brands of fuses tested ignited the gas, although in varying degrees. Two brands ignited the gas but once; three brands ignited it in more than 50 per cent of the trials.

2. The principal source of danger in fuses as they are now designed is the device for indicating whether or not a fuse has acted.

3. Danger from blowing at the relief ports will probably develop in some and possibly in all brands if tested with enough generating capacity.

## AN OPTICAL ILLUSION IN ENGINEERING.

BY ROBERT SIBLEY.

As a recompense for the hardships endured by the engineer as he enters an unexplored field, in his lighter moments there arise many strange and interesting natural phenomena for thoughtful and philosophic consideration. As he wearily packs his transit across the desert the phenomena incident to a mirage afford him constant diversion from the effects of the heat. In the high mountains the ever unfolding beauties of exquisite scenery repay him many times for his severe climb, or should his duty lead him into the heart of our great forests, the variety of foliage, the scent of the fragrant wild rose and the sparkling clear waters are a constant source of delight.

To layman and engineer alike, occur one interesting optical illusion, which has ever varying explanations given to it. Everyone of us has noted it from time to time as we have followed with our eye the winding course of the newly-constructed hillside ditch. I say "newly-constructed" for the phenomenon is more easily discerned in the early life of a ditch, the contrast between the newly deposited earth and the old making its outline the clearer. As we follow the ditch outline with our eye the ditch in its course up a gully jumps down into it only to be seen on the other side laboriously climbing again to attain what it has lost.

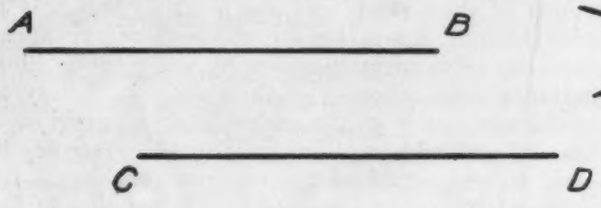



Fig. 1.

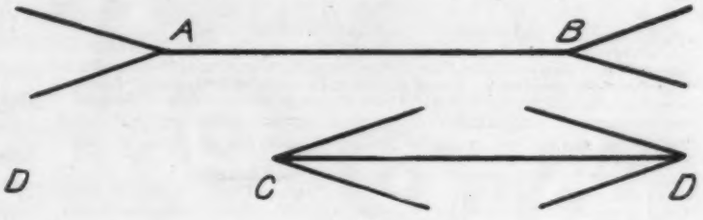



Fig. 2.

So deceptive appeared this phenomenon in one instance after I had carefully located a ditch in Western Montana, my Irish foreman strenuously objected to going ahead with the construction. "Why, soir," said he, "the watter will niver run up there." As old Tom Hennessy was a very careful man, I re-checked the work unobserved to be sure that I had made no error. Meanwhile so positive was the foreman that some mistake had been made, he went to the local field manager with his complaint and finally they both brought the general manager to look at the located ditch. Upon being asked by the general manager if he had put an instrument upon the work, old Tom replied: "Why, by jabbers no, me eye tells me that, soir." Whereupon all three agreed there must be some mistake. So positive were they that I actually became alarmed myself, but notwithstanding I ordered the work to proceed and I heaved a mighty sigh of relief when upon trial the water ran across the "up-hill" part as smoothly and evenly as could be desired.

After such an experience as this I have given the matter of an explanation of the phenomenon considerable thought. Before giving my views I will first cite another illustration. Take two lines of exactly the same length as A B and C D, in Fig 1. Add the diagonal lines emanating from A, B, C and D as shown in Fig. 2, and now look at your figure. How small C D looks compared with A B. Professor Ladd in his book on Psychology explains this phenomenon as being due to the strain upon the eye in following convergent and divergent lines, the eye in following the path of least strain conceives A B as being much longer than the C D, for it is much easier to follow the convergent lines from A and B than the lines making an angle of amost 120 degrees at points C and D with outward direction from C and D, hence the optical illusion that A B appears longer than C D.

A similar explanation easily follows in observing a ditch location. The eye is accustomed to observing the horizon and this is used as our datum plane. Unconsciously we think of the horizon as being a level plane, and it naturally follows that we think of the ground around us as being level. So it is as we look up a gorge, we think of the bottom of the gorge as being level while in reality it may have a rapid fall to it. Consequently as we follow the ditch or flume on one side it apparently verily jumps down into the gorge and on the other side it laboriously crawls up again to regain its fallen supremacy. Hence follows the glowing report of the eastern visitor after having observed some of our western hydraulic enterprises that "water runs up hill in the west."

---

## ELECTRIFICATION COSTS.

The following data are given by W. S. Murray in a paper before the American Institute of Electrical Engineers: Power houses can be constructed, depending upon the capacity, from $90 to $110 a kilowatt; line construction for one, two, four and six tracks can be erected at costs varying respectively from $4000 to $7000; from $8000 to $15,000; from $25,000 to $40,000; $40,000 to $60,000 a mile; the fluctuation in cost for these respective constructions depending entirely upon the standards elected, which are inclusive of the consideration of importance of track, in turn bringing into consideration the advisability of wood and steel and steel post construction, cross catenary and bridge span construction, single or compound catenaries, etc., also the cost of overhead yard construction can vary from $1500 to $3000 a mile, depending upon the number of tracks spanned and type of construction selected. Locomotives of the passenger road and switching type, depending upon the nature of their service, can vary in cost from $25,000 to $45,000 a unit.

# JOURNAL OF ELECTRICITY
POWER AND GAS

PUBLISHED WEEKLY BY THE
Technical Publishing Company
604 MISSION STREET, SAN FRANCISCO

E. B. STRONG, President and General Manager
A. H. HALLORAN, V. P. and Managing Editor
ROBERT SIBLEY, Treasurer and Editor in Chief
C. L. CORY, Secretary and Special Contributor
A. M. HUNT, Director and Special Contributor

EASTERN OFFICE, 140 NASSAU STREET, NEW YORK

TERMS OF SUBSCRIPTION

| | | |
|---|---|---|
| United States, Cuba and Mexico | per year, | $2.50 |
| Dominion of Canada | " | 3.50 |
| Other Foreign Countries within the Postal Union | " | 5.00 |
| Single Copies, Current Month | each | .25 |

NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office *ten days in advance of date of issue.* New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

Entered as second-class matter at the San Francisco Post Office as "The Electrical Journal," July 1895.
Entry changed to "The Journal of Electricity," September, 1895.
Entry changed to "The Journal of Electricity, Power and Gas," August 15, 1899.
Entry changed May 1, 1906, to "The Journal of Electricity, Power and Gas," Weekly.

FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN


## CONTENTS


California Contractors Camp at Catalina ..... 91

New Experiments on Increase of Wind Pressure Upon Small Wires ..... 95
*By F. C. Piatt, H. S. Lane and L. A. Kistler.*

The Electrical Section of the Bureau of Mines, Its Purpose and Some Fruitful Results ..... 101

Book Review ..... 102

Progress and Intense Interest in Panama Canal ..... 102

An Optical Illusion in Engineering ..... 103
*By Robert Sibley.*

Electrification Costs ..... 103

Editorial ..... 104
Echoes of the Coronation.
Electrical Section Bureau of Mines.
Depreciation.

Personals ..... 106

Annual "Jollyup" Baseball Game ..... 106

Patents ..... 107
Lock for Fire-Alarm Boxes.
Pump for Oil Wells.
Oil-Burner.
Loading Device.
Guard for Fire-Alarm-Box-Door Keys.

Industrial ..... 108
Shunting Versus Bridging of Railway Motors.
New Household Generating Set

Trade Notes ..... 108

New Catalogues ..... 109

News Notes ..... 110


*Photographs illustrating the California Contractors' Camp in this issue were furnished through the courtesy of the Panama-Pacific Photo Co.*

**Echoes of the Coronation**

Our British cousins have now completed in every detail their spectacular and time honored coronation ceremonies. The guests, whether invited or uninvited, went to look on and now for the most part, have departed on their separate ways. Engineers of America feel proud of their country's official representative at the ceremonies. Mr. Hammond, who is one of our most distinguished engineers, performed his part at the ceremonies in admirable style. Engineers the country over read with delight the fanciful accounts of this knight of the camps of years ago, transferred from high-legged boots and uniform of the miners' life to the knee breeches of the Court of St. James.

Now that the hurby-burly is passed, a time for serious reflection has come for everyone as the features connected with the gigantic ceremonies of the coronation are reviewed in mind. It is perhaps truthfully said that the event surpasses all spectacular gatherings of the ages. This spectacular effect was not only brought about by the richness of the apparel worn by all participating, but by the gigantic illuminating effects, eclipsing in their dazzling beauty and in the magnitude of the undertaking all previous attempts, and adds another mile-stone of accomplishment to the record of the electrical engineer. It is estimated that in the coronation illumination in London and suburbs between 2,500,000 and 3,000,000 electric lamps were utilized. Not one single case of fused wire has been reported. All honor to our brother engineers across the ocean.

**Electrical Section Bureau of Mines**

The Bureau of Mines has just announced by Bulletin, the formation, the equipment and purpose of the electrical section of the Bureau. Elsewhere in this issue will be found a detailed account of this announcement. Briefly, its purpose is to endeavor to solve the problem of safe-guarding life and property from the dangers which attend the use of electricity underground, the principal dangers being from electric shock, explosions caused by electricity and fires started by electricity. Naturally follows the final purpose which is to solve the problem of safeguarding the use of electricity in mines. This can be brought about only by the adoption of protective measures and devices that are simple, rugged, "fool proof" and as inexpensive as possible.

This new undertaking on the part of the Bureau of Mines comes at an opportune time in Western development. Coming at a period when renewed interest in mining is evident on all sides, the results of the labors of the electrical section of the Bureau will be watched with intense interest. At no time in the development of the mining industry has the demand for electric energy been greater than at present. This is instanced by the fact that a prominent feature of the expert's report on the outlook for either prospect or mine is usually given over to possibilities of nearby purchase of electric power or economic development of the same.

But little at present is known as to methods of preventing mine disaster due to the more complicated electrical causes. It is usually during the early stages of its use in mines that accidents most frequently occur. If the mine is still in a non-dividend paying condition, the management as a rule cannot well afford the time and money to be spent in a study of prevention of disaster, although most mining superintendents would gladly install equipment for preventing disaster of this sort if the same could be reasonably purchased.

One of the best results to be anticipated is the compilation for distribution of simple, plainly written literature on the subject. This will enable the prospector or the miner who usually has, from years of toil observed much natural geology and mineralogy, but little in affairs electrical, to properly protect himself. For after all it will undoubtedly be found that disaster from the use of the simple electrical apparatus used underground, as a rule, follows from ignorance of the fundamental laws of electricity.

---

**Depreciation**

The question of arriving at the proper factors of depreciation in any particular plant in the public service corporation is one of delicate determination and one which necessitates the weighing of many points involving largely the mature judgment of the expert. Similar to all other questions concerned with the uncertainties of life, the theory of probability must to a large extent enter into the choice of the particular factors of depreciation to be used. The mortality or life tables used in the insurance companies furnish an excellent example how applicable such theories are in practice when the point under consideration appears hundreds and hundreds of times so that average values can be used.

Since large numbers of similar parts are necessary in order to use current theories of probability, the property to be evaluated must have been in use for such sufficient period of time as will make the annual expenses for maintenance and repair practically uniform. It is evident also that the greater the number of similar parts contained in the property to be evaluated, the more nearly will the theory of probability apply. Hence it is true that in ascertaining the depreciation of rolling stock of a similar make in a manufacturing establishment, cross ties of a railroad, or transmission poles and cross-arms of a transmission line, it is possible to theorize with considerable exactness. In considering electrical properties, the generating units are generally few in number, consequently our theory cannot be made to apply with exactness. In a property involving, however, a large number of similar parts a very convenient method has been deduced from theory. It is the so-called "50 per cent method" and has been used by many eminent experts in evaluating public service corporations. The rule is to ascertain 50 per cent of the cost less salvage. This immediately gives the amount to be written off as depreciation.

In electrical properties as stated above, many of the parts do not appear in large numbers so that the 50 per cent method cannot be used. In considering depreciation of a single unit much depends on the point of view to be taken in arriving at a value. Those who have been so fortunate, or unfortunate, as to own an automobile know that the day after the machine has been purchased, it cannot as a rule, be sold for anything like its purchase price, yet the machine is practically as good as new and for service will probably last as long as a new one. So far then as its value to the user is concerned, it has depreciated only in such amount as would be necessary to replace the simple minor ill-effects acquired during its short usage. Unquestionably the value as a usable property should be the proper value to be arrived at. Henry Floy, the noted evaluation expert, in his paper on depreciation, presented before the recent Chicago convention of the American Institute of Electrical Engineers, went into the various factors entering into the determination of depreciation of electrical properties in a scholarly manner. Mr. Floy gives a list of constants used in assuming depreciation per year and quotes a number of cases in which these constants were used, stating the authority of each. In some cases authorities differ widely. For instance, the Wisconsin Public Service Commission claims that for arc lamps four to five per cent per annum should be allowed as depreciation, but a Board of Arbitration at Atlanta, Georgia, claims that 15 per cent should be allowed. Again in considering the depreciation of generators, the Traction Valley Commission claims 3 to 8 per cent, B. J. Arnold 5 per cent, Henry Floy 5 per cent, Wisconsin Public Service Commission 6 2/3 per cent, Arbitrators 10 per cent, and the St. Louis Public Service Commission 6 2/3 per cent. No information is given as to how these constants were arrived at by the several authorities quoted. Undoubtedly they are largely empirical, the authority in question taking all elements into consideration, after a personal inspection of the apparatus. It is apparent that the constants must be used with much care by the profession at large. Personal inspection of the plant management and its general make-up is of the utmost importance in determining whether a low factor or a high factor should be used. Years ago Ganguillet and Kutter published to the world their celebrated empirical formula for calculation of flow of water in ditches and canals. It will be recalled that in computing the final constants to be used much depends on the so-called coefficient of roughness of the particular ditch or canal made use of in conveying the water. There is no doubt but that in using proper constants for depreciation factor, the expert of the near future, if the expert of the present has not already done so, mentally at least, will evolve a series of coefficients of "managerial roughness" to be applied in his computation. To take our homely illustration of the automobile again, the expert will weigh in his mind the roughness of the attendant, the same as we weigh in our minds the probability of our arriving at a destination by automobile by observing the care with which the chauffeur avoids the rock in the road, the incoming cars or even the telegraph poles along the road.

This coefficient of roughness then, will be determined from the impressions the expert acquires during the personal inspection of the operating forces.

## PERSONALS.

G. H. Hoxie, an electrical engineer from New York, is at San Francisco.

M. P. Waite, an electrical supply man of Los Angeles, is a San Francisco visitor.

J. B. Day, who is interested in the traction lines of Chicago, is a recent arrival at San Francisco.

Rudolph W. Van Norden has returned to San Francisco from an engineering trip through Lake county.

H. T. Van Riper, who is connected with the manufacture of electric irons, is a recent arrival at San Francisco.

Leon Bly, secretary of the Tehama Light & Power Company of Redding, was at San Francisco during the past week.

H. R. Austin, secretary to the president of the Los Angeles Gas & Electric Company, was at San Francisco during the past week.

F. A. Cressey Jr., who is interested in the management of the gas plant at Modesto, was a San Francisco visitor during the past week.

Ely Hutchinson, of the Pelton Water Wheel Company's sales force, returned to the San Francisco office during the past week from a trip to Portland.

Fred L. Webster, Pacific Coast manager of the Allis-Chalmers Company, left for Seattle last Saturday and will spend a week in visiting the Northwest branch office.

Wynn Meredith, Pacific Coast manager for Sanderson & Porter, is once more at his San Francisco office after inspecting the engineering work in progress at Victoria, B. C.

John W. Burke, one of J. G. White & Co.'s civil engineers on electric railway work, who spent some time on the Oakland & Antioch Railway project, left for New York last week.

J. P. Hermans has returned to the San Francisco office of the Colonial Agency Co., after a successful trip through Northern California in the interests of Economy and Colonial lamps.

H. A. Lardner, manager of J. G. White & Co.'s Pacific Coast branch office, spent the past week in Southern California inspecting electrical engineering work in progress at various points.

A. C. Balch and W. G. Kerckhoff, who are interested in the Pacific Light & Power Company and the San Joaquin Light & Power Corporation, have returned to Los Angeles after an Eastern trip.

H. C. Goldrick, manager of the Pacific Coast branch of the Kellogg Switchboard and Supply Company of Chicago, has returned to his San Francisco office from Portland, where he secured a good contract.

F. W. Mahl, formerly a local mechanical engineer, who was at San Francisco during the past week, is now assistant director of maintenance and operation of the Southern Pacific Company under Julius Krutschnitt.

President D. A. Chappell of the Nevada-California Power Company, is expected to arrive at San Francisco from Denver within a few days, accompanied by C. O. Poole, of Manifold & Poole, the company's engineers.

Harry Hartwell, of Sanderson & Porter's engineering staff, recently went to Victoria, B. C., where he will remain two months in connection with a contract on the municipal water works before returning to New York.

The new executive committee of the San Francisco Section of the A. I. E. E., is composed of the following: W. A. Holabird, H. W. Crozier, F. F. Barbour, S. B. Charters and H. A. Laidner. As it is usual to start the new year with some sort of entertainment, speculation is rife among the local members as to what the executive committee have up their sleeve.

The convention of the National Electrical Contract Association ended with the election of M. L. Barnes of Troy, N. Y., as president. The 1912 convention will be held in Denver.

Gregg Curtin, Pacific Coast manager of the International Electric Protection Company of New York is a visitor in San Francisco. The company has just completed a thoroughly modern and efficient installation of their system at the Presidio and most satisfactory tests were put through during the past week.

Harry A. Mitchell, formerly auditor of the Central California Traction Company, has been made superintendent to succeed S. L. Naphtaly, who recently became general superintendent of the Great Western Power Company. The offices of the Traction Company and of the Sacramento Valley Power Company have been removed to Room 702 Shreve Building.

H. W. Jackson, assistant general manager of the Sierra and San Francisco Power Company, recently visited the hydroelectric plant at Vallecito in connection with the starting of actual work on their second impounding dam on the Stanislaus River. A moderate force of men will be employed by the company on construction this season, under the engineering supervision of Ford, Bacon & Davis. The new dam will be below and of about the same size as the "relief" dam and about 60 miles above the power station.

Dr. Frederick G. Cottrell, assistant professor in the department of physical chemistry in the University of California at Berkeley, has sent in his resignation, in order to accept a position with the United States government as physical chemist in the Bureau of Mines. Cottrell is the inventor of an electrical smoke-condenser for smelters and has done much to solve the problem of removing injurious acid fumes from smelter smoke. He also invented a process for removing the water from crude petroleum in tanks or reservoirs.

George Pancoast, mechanical engineer for the Hearst newspapers, is at San Francisco, superintending the installation of a number of large presses and other machinery of the plant of the Daily Examiner, in the new twelve-story building on Stevenson street, near Third. The first papers will be printed in the new pressroom on the 29th of July. Each of the seventy machines of all kinds will have an individual direct-connected motor. The five big presses, which require variable speeds, will be driven by d.c. motors, the Koehler, Janney and General Electric systems of control being used. A.c. motors are used with those machines which require constant speed. The new five-roll press will be capable of printing 72,000 twelve-page or 50,000 twenty-page papers an hour. All of the a.c. motors were purchased from the General Electric Company.

## ANNUAL "JOLLYUP" BASEBALL GAME.

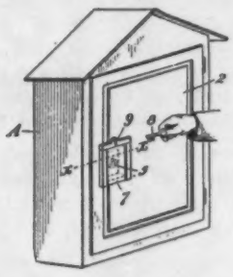
Great interest was shown in electrical circles in the baseball game on the St. Ignatius diamond last Saturday between two teams composed of the hiyu-muck-a-mucks of the Pacific Gas & Electric Company and the San Francisco Gas & Electric Company. The score was 19 to 8 in favor of the Pacifics, showing that there is some advantage in being with the holding company. Chief of Police "Gus" White was available to prevent possible hostilities. The teams lined up as follows:

San Francisco—F. H. Varney, third base; F. E. Oldis, left field; H. Bostwick, shortstop; G. C. Holberton, right field; Gus White, first base; H. P. Pitts, center field; E. E. Keppleman, catcher; A. R. Thompson, second base; J. D. Butler, pitcher.

R. J. Cantrell, third base; J. H. Wise, left field; C. J. Wilson, shortstop; P. M. Downing, catcher; E. B. Henley, center field; L J. Newbert, first base; A. H. Caine, right field and pitcher; S. J. Lisberger, second base; Charles Lusk, pitcher.

# PATENTS

**998,493. Lock for Fire-Alarm Boxes.** Anton Glock, San Francisco, Cal. Filed Sept. 13, 1910. Serial No. 581,825. The combination with a fire alarm box and the door thereof, said door having a pocket with a glass plate forming a guard to the interior of the pocket, of a lock casing secured inside the door, a latch bolt mounted in the casing, a permanent key

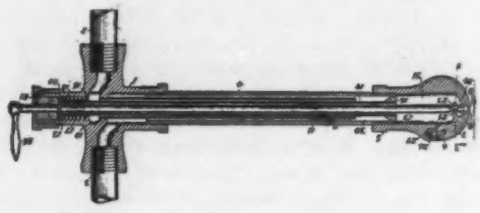


carried by the door at one side of the center thereof, said latch bolt having projections from each side of its center, one of said projections extending into the range of action of the permanent key, and a removable key insertible into the casing at the other side of the center of said latch bolt and adapted to engage the other extension thereof whereby the bolt may be operated independently of the permanent key.

**998,076. Pump for Oil Wells.** Daniel Daniels. Los Angeles, Cal. Filed Aug. 22, 1908. Serial No. 451,102. In a pump for oil wells, a casing having its ends externally screw-threaded, a coupling screwed upon each end of said casing, and a lining within the casing consisting of a plurality of liner sections, each section having at each end a portion of

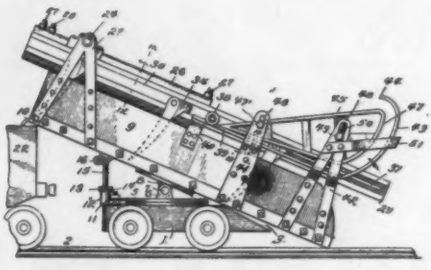
reduced exterior diameter with a smooth exterior surface, and such portion being provided with a shoulder, and a band fitting upon the reduced portions of adjacent ends of the sections at each joint between the respective sections, thereby holding the sections in alinement, the sections being supported in position within the casing by their engagement with the counterbored portion and shoulders of the couplings.

**997,981. Oil-Burner.** Milton A. Fesler, San Francisco, Cal. Filed Nov. 2, 1909. Serial No. 525,881. In an oil burner, the combination of a steam conduit, an oil conduit within the steam conduit, discharging into one end thereof, a valve tube within the oil conduit and projecting beyond said oil conduit to the end of the steam conduit, a valve on said tube adapted to close the end of the steam conduit, a guide for said tube, a coiled spring around said tube, and a device secured upon the end of said tube against which said coiled



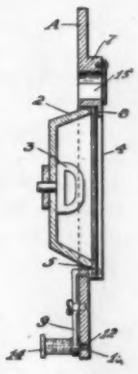
spring presses to close said valve against the end of the steam conduit, substantially as described.

**998,378. Loading Device.** Isaac Newton Myers, Los Angeles, Cal. Filed Aug. 17, 1909. Serial No. 513,221. A pivoted steam chest or cylinder, guide ways upon the sides of the cylinder, slides carried by the guides, shovel members



carried by the slides and depending therefrom, means upon the slides for preventing the swinging of the shovels in one direction, means for tilting the cylinder to elevate the slides and shovels, means for lowering the slides and for returning the slides and shovels to their initial position.

**998,494. Guard for Fire-Alarm-Box-Door Keys.** Anton Glock, San Francisco, Cal. Filed Sept. 13, 1910. Serial No. 581,826. The combination with a fire alarm box, of a suitable pocket formed therein and housing a key, a casing formed on the outside of the door and around the pocket, said casing being opened from below, a glass plate closing



said pocket and inserted into the casing from below, into a pivoted latch acting on the bottom edge of the glass plate for supporting said plate against gravity and to hold the plate in place, said latch adapted to swing in a plane parallel with the face of the glass and to a point beyond the plane of the vertical edge thereof.

# INDUSTRIAL

## SHUNTING VERSUS BRIDGING OF RAILWAY MOTORS.

**Railway Engineering.**

By referring to Fig. 1, which shows a schematic diagram for a typical Westinghouse type HL control equipment, the details of the K type arrangement may be more readily understood. With the controller on the fifth notch, which is the full series position, the current comes from the trolley through switches LS, R1 and R3, then divides through Nos. 1 and 3 motors, next goes through switch S, and finally divides through Nos. 2 and 4 motors to ground.

When the controller handle is moved toward the sixth notch, switch R1 first drops out. Current then enters through switch R2, part of it going to the motors through

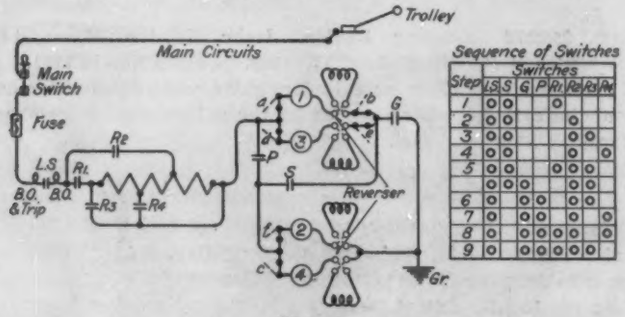



Fig. 1.

one section of the resistance and the remainder through the other section and through switch R3, after which its path is as before. The result, therefore, has been to insert resistance in the circuit.

As the handle is moved further, switch G next closes, This allows the current to go direct to ground, after dividing through Nos. 1 and 3 motors, without passing through Nos. 2 and 4; that is, this short-circuits Nos. 2 and 4 motors.

As the handle is moved still further, switch S then opens cutting off Nos. 2 and 4 motors from the series connection and switch P closes, connecting them in parallel with Nos.

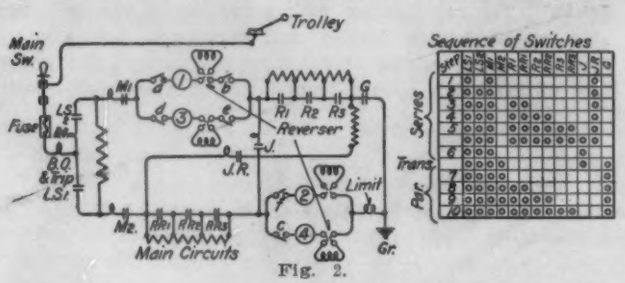



Fig. 2.

1 and 3. The change to parallel is then complete. It will thus be seen, that this sequence of changes (which, although requiring many words to describe, takes place in a small fraction of a second) maintains a current, whose value depends on the design of the resistance, through Nos. 1 and 3 motors during the entire time and thus maintains the speed of the car, instead of allowing it to fall off, as with the L type connection.

The shutting off of power from even one-half of the motors while changing from series to parallel, can be avoided and current maintained in all of them, if desired, by the use of the somewhat more complicated arrangement of circuits shown in Fig. 2. With this arrangement, in the series position, current flows from the trolley through switches LS2 and M1, divides through Nos. 1 and 3 motors, passes through switch J, and thn divides through Nos. 2 and 4 motors to ground. In changing to parallel, switches M2 and G are first closed, giving a second path for current from the trolley through the switches LS1 and M2 through the first set of resistance, through switch J in opposite direction to the motor current, through the second set of resistance and finally through switch G to ground. Switch J is then opened, leaving the motors connected in parallel instead of in series and with the first set of resistance in circuit with Nos. 2 and 4, and the second set in circuit with Nos. 1 and 3. It will thus be seen that the change has been made without interrupting the current to any of the motors.

This arrangement is called the "bridging connection." It was first put out with the automatic type of unit switch control and more recently it is used in some of the latter types of controllers such as K-34, etc.

Comparing the three general schemes of changing from series to parallel, the obvious advantages of the K type over the L type are obtained with no additional switches and no added complication of circuits, so that the perfection of the former method leaves no logical reason for any further use of the latter. The much less important advantages of the bridging connection over the K type, however, can be obtained only at the cost of a considerable number of additional switches to give the same number of controller notches as well as greater complication of the circuits. For instance, to obtain the same number of notches with the bridging connection as are obtained in Fig. 1 with eight switches, there would be required the thirteen switches shown in Fig. 2. On this account, simplicity being so essential an element in all matters relating to railway equipments, the bridging connection cannot be regarded as superseding the K type, but merely as a refinement for application in certain particular cases.

Theoretically, the bridging connection gives smoother acceleration, but practically, the K type with a properly proportioned resistance, leaves so little to be desired in this respect that it is impossible to tell by riding on a car which form of control is employed.

For controlling large motors operated from a power system with close regulation and large capacity, the ability to maintain the load on all motors throughout the accelerating period, together with the inherent possibilities of better acceleration, makes the bridging connection preferable. Where automatic acceleration is employed also, it is somewhat easier to provide a system of interlocks to produce the particular sequence of switches required for the bridging connection than it is for the K type. For this reason, automatic unit switch control equipments, since they are usually employed with powerful motors on large third-rail systems, are, except in the very smallest sizes, designed with the bridging connection. Westinghouse type HL equipments, however, which are as a rule employed for city or interurban service, have been designed with the K type connection in order to secure that simplicity and reliability which has made them so remarkably successful and satisfactory, even in the hands of inexperienced men.

---

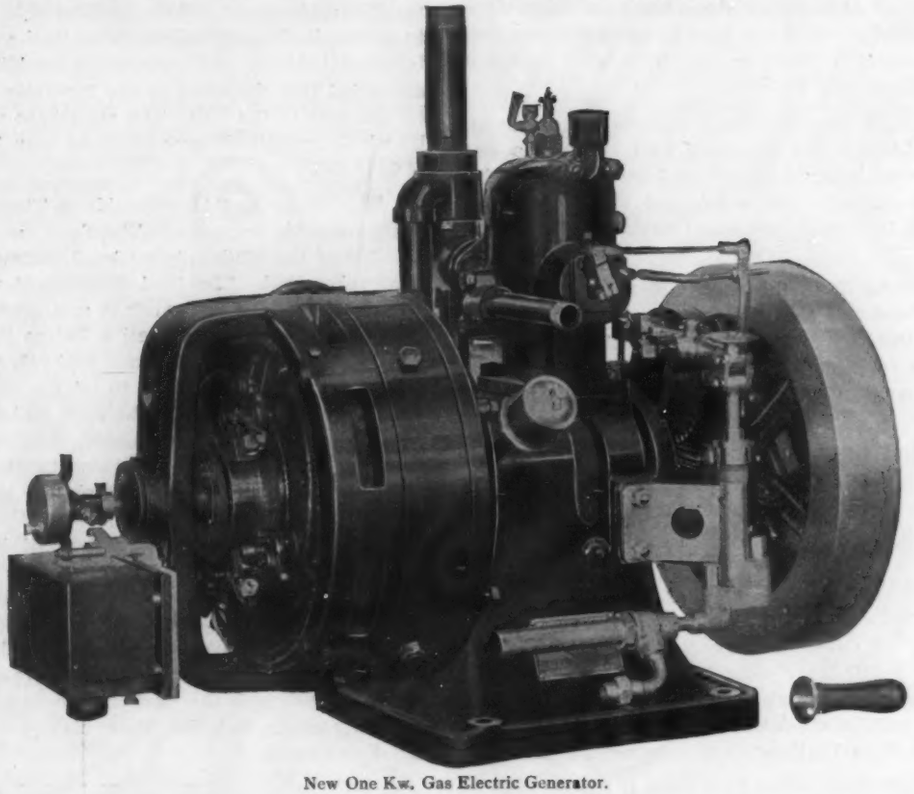
## TRADE NOTE.

The Northwest Electrical Equipment Company, formerly at 530 Lumber Exchange, Portland, Oregon, manufacturers' agents, have moved to No. 7 North First street, where they have a ground floor office. Mr. Banes, formerly with the J. C. English Company, is manager of the firm.

## NEW HOUSEHOLD GENERATING UNIT.

The advantages of electricity for illumination and power make it indispensable to this enlightened age, yet many people who would like to use it are not within the zone of distribution of an electrical system and so to enjoy the advantages of electricity must install their own plants.

The General Electric Company, who manufacture gasolene electric generating sets of capacities 3, 5, 10 and 25 kw. have added to this line a 1 kw. set which is designed for furnishing electricity for power and lighting in private residences, small hotels, rural railroad stations, etc., not now served by central stations, and on board boats. This set comprises a single cylinder, vertical, 2-cycle water cooled gasolene engine direct connected to a 1 kw. d.c. generator. The regulation and steadiness of the voltage of this set is so good that it is possible to supply current direct from the generator, thus avoiding the expense of installing and maintaining a large battery and the loss of power and troubles incidental to the operation of the latter.



New One Kw. Gas Electric Generator.

The engine is provided with a suction gasolene pump for lifting fuel from a tank placed under ground and located at some distance from the engine, thus fulfilling the requirements of the National Board of Fire Underwriters.

The cooling is by thermo siphon, thus doing away with the necessity of a pump to provide forced circulation of the cooling water.

The governor is located in the engine fly wheel and operates a throttle valve, giving very close regulation and satisfactory operation at all loads.

The dimensions of this 1 kw. set are: Length, 2 ft. 6⅝ in.; height, 2 ft. 2 in; and width, 17⅝ in, and the total weight is 350 lbs.

Recognizing the fact that it is frequently desirable to install a small storage battery to provide a few lights on occasions when the generating set is not running, the General Electric Company manufactures for use with these sets a suitable board for controlling both the generating set and such a battery, as well as two types of switchboard for controlling the set alone.

The combination generator and battery switchboard is so arranged that the battery can be charged at the same time that the generating set furnishes power for lights or motors, without affecting the operation of those appliances, while when the battery is fully charged it can be connected with the system so that the generating set can be shut down without interrupting the service.

---

## NEW CATALOGUES.

A small folder, No. 4206, on Westinghouse Automatic Section Insulators, has just been sent out by the Westinghouse Electric & Mfg. Company, East Pittsburg, Pa. The folder gives the applications with style numbers, sizes of wire, and cross-section views, and will be sent to anyone interested on application.

The Westinghouse Electric & Manufacturing Company, East Pittsburg, Pa., has issued Folder No. 4301, "Charging the Automobile Battery with Westinghouse-Cooper Hewitt Rectifier Outfits." The folder is well illustrated and describes outfits and accessories. It will be sent to anyone interested on application to the Westinghouse Department of Publicity, East Pittsburg, Pa.

The General Electric Company has just issued Bulletin No. 4845 containing illustrations and descriptive matter in considerable detail of its horizontal steam turbine generators of from 100 to 1000 kw. capacity at 3600 r.p.m., which is the maximum speed possible for use with 60 cycle alternating current generators. These units are particularly adapted to industrial and lighting plants requiring the economical generation of a moderate amount of power.

The engineering department of the National Electric Lamp Association have recently published two bulletins of much interest to the consumer. The bulletin on the economical operation of incandescent lamps goes into these features from the standpoint of both consumer and central station and is interesting and instructive. The second bulletin is on "Mazda" incandescent street lighting and is replete with information covering this particular phase of illumination.

# NEWS NOTES

## FINANCIAL.

TACOMA, WASH.—Caldwell Brothers received the contract for installing a lighting system in the court house at a cost of about $3000.

OXNARD, CAL.—The City Trustees are considering the advisability of issuing bonds for the installation of a municipal water system. It is estimated that an issue of $100,000 will cover the expense.

SAN FRANCISCO, CAL.—Stone & Webster announce that a quarterly dividend of $1.50 per share has been declared on the preferred capital stock of the Sierra Pacific Electric Company, payable August 1, 1911, to stockholders of record at the close of business, July 20, 1911.

LAS CRUCES, N. M.—The Board of Directors of the Las Cruces Electric Light & Ice Company have received a message that their bond issue of $75,000 of 6 per cent bonds has been sold. The proceeds are to be used to retire present indebtedness and to furnish additional equipment and extensions.

VALLEJO, CAL.—With the ending of the fiscal year on June 30 it has developed that the receipts for the municipal water supply of this city amounted to $78,753.99, which is an increase of close to $8000 a year over the record of a year ago. This will mean a net profit to the city of something like $60,000.

NORTH BEND, ORE.—T. B. Nolan of Omaha, Neb., has negotiated for the purchase of the Flanagan & Bennett Water Power Co., which furnishes power for North Bend. The deal is held up pending receiving a franchise. If the deal is closed the purchaser will build a new reservoir and make extensive improvements.

RANDALL, WASH.—The Valley Improvement Company of Portland, Ore., Mr. Green, manager, is getting camps established and other preliminary work in shape to begin active construction of the power plant near here. It is reported that some $15,000,000 will be spent in developing the water power and transmitting it to Portland.

LOS ANGELES, CAL.—The City Council has adopted an ordinance authorizing the issuance and sale of the power bonds in the sum of $3,500,000. They will not begin to mature until 1917. The Council will yet have to pass on the policy of selling all the bonds in the open market or selling only part of them to the city sinking fund.

SAN FRANCISCO, CAL.—The Supervisors sitting as a board of equalization, have denied the application of the Spring Valley Water Company for a reduction of several millions of dollars in its assessment. Assessor Washington Dodge filed a written statement justifying the assessment, and the board unanimously sustained his figures. The basis of the company's plea for a reduction was that the State Board of Equalization this year assessed the Spring Valley franchise under the new State revenue law, fixing its value at more than $3,600,000, and that the franchise element of the company's property, which Assessor Dodge in previous years assessed at $2,500,000, was taken into account by him this year and assessed under another name, being included in the company's personal property valuation. The company contended that it was thus being taxed twice on its franchise. Under the new State tax law the State Board of Equalization alone is authorized to assess corporate franchises. Spring Valley applied to the State Board for a reduction of its franchise assessment but was refused.

SAN FRANCISCO, CAL.—City Attorney Percy V. Long has petitioned the finance committee of the Supervisors to set aside $15,000 out of the fund of the sale of the water bonds to defray the expenses of the preparation of data in regard to the Hetch Hetchy-Lake Eleanor-Cherry Creek water site. The data is being prepared by Engineer C. E. Grunsky and is to be presented to the Board of U.S.A. Engineers now making a study of the situation for the Government.

RIVERSIDE, CAL.—The committee appointed by the Council to investigate the matter of a municipal water system for Riverside reports that the Riverside Water Company is to refund its bonded indebtedness in the sum of $750,000. It is urged that the city proceed to establish a system and is suggested that the stock of the Riverside Water Company be turned over to the city. The committee also suggests a plan by which an entirely new company may be formed at a cost of $225,000.

WOODLAND, CAL.—President Thomas T. C. Gregory of the proposed Sacramento-Woodland electric line, states that $750,000 of the million dollar bond issue of the company had been subscribed. The fund thus raised will be used in the construction of the line, work to commence within a few days and the line to be in operation before the end of the year. The balance of the bond issue, $250,000, will be floated after the road has been completed to raise a fund for the extension of the line to Winters. Of the $750,000 bonds sold, the banks of Woodland have taken $215,000, the Natomas Consolidated Company and the West Sacramento Company have taken $250,000, and the Sacramento Bank and individuals connected with that institution subscribed the balance making up the three-quarters of a million dollars of bonds floated. The bridge of the lines over the Sacramento River will be completed by September 1. All the piers are in and the steel has been placed between two of the piers. Forty-two carloads of steel have arrived to be used in the completion of the bridge. An effort is being made to have the State enter into an agreement with the new line to construct a joint grade for the railway and the State highway between Woodland and Sacramento.

## INCORPORATIONS.

BRAWLEY, CAL.—The Schenck Project Water Users' Association of Holtville has been incorporated with a capital of $500,000 The directors are W. J. Seat, C. J. Schenck, M. A. Kendall.

SAN BERNARDINO, CAL.—Amended articles of incorportation of the East Redlands Water Company have been filed. The capital is $100,000. The place of business is Redlands. The original incorporators were H. L. Drew, Lewis Jacobs, H. M. Barton.

## ILLUMINATION.

EUGENE, ORE.—The city water board will at once advertise for bids on furnishing poles for the city's projected lighting system.

ELLENSBURG, WASH.—This place is circulating petitions urging the immediate installment of additional cluster lights on streets.

PHOENIX, ARIZ.—A thunder storm raging above the Roosevelt storage dam recently broke the intake canal of the government electric plant which furnishes Phoenix with light and power.

ADAMS, ORE.—W. B. Salt, representing the Pacific Power & Light Company, of Portland, is considering the installation of an electric light system at this place.

BAKERSFIELD, CAL.—A movement is being agitated by local merchants looking toward the installation of an electric plant to supply the business section of the city with lights.

CONCONCULLY, WASH.—Within the next six weeks this city is to be electrically lighted, according to the statement of J. D. Morton, owner of the franchise granted by the Council.

WALLA WALLA, WASH.—The city clerk has been instructed to advertise for bids for furnishing electric power for the arc and cluster lights in the city for both five and ten-year periods.

ANAHEIM, CAL.—J. H. Ahlborn has reported to the Board of Trade on the installation of lights for the business streets and has been appointed a committee of one to take up the matter with the business men.

CHICO, CAL.—At a recent meeting of the City Trustees the matter of an electrolier street lighting system in the business district was informally discussed. As a result the board will obtain figures on the cost of installing the system.

## TRANSMISSION.

COLTON, CAL.—The Edison Electric Company is to build a new power house at M and Eleventh streets.

EUREKA, NEV.—The power plant located at Jack Creek about 21 miles from Tuscarora, Elko County, was struck by lightning last week and burned to the ground.

WEAVERVILLE, CAL.—The Trinity Dredging Company has made application to the Board of Supervisors for a franchise for a transmission line in the county of Trinity.

SANTA ROSA, CAL.—The contract for the erection of the new power house at the county farm has been formally awarded to Hoyt Bros. of this city, the lowest bidder.

LOS ANGELES, CAL.—An ordinance has been adopted granting the Pacific Light & Power Company a franchise to operate and maintain an electric pole and wire system in the County of Los Angeles.

NORTH YAKIMA, WASH.—The Pacific Power & Light Company has made application to the Commissioners of Yakima County for a franchise for a period of 50 years, authorizing the county to operate transmission lines within the County of Yakima.

EUREKA, CAL.—Sealed bids will be received by the Clerk of the Board of Supervisors at his office, in the Court House, up to August 14th, 1911, for a 50-year franchise to erect and maintain poles and string wires for transmitting electric power along the public roads in district No. 5.

BUTTE CITY, CAL.—The Northern California Power Company, which is constructing a 60,000 volt power line from Hamilton City to Princeton, is now within a short distance of Princeton. The crew is erecting about half a mile of line and poles daily. Copper and aluminum wire is being used. The sub-station has been erected on the river bank near the bridge. It is stated here that the company plans to extend its line south to Maxwell, Williams and other points, and that the plant at Williams has been taken over.

SACRAMENTO, CAL.—The Citizens' Light & Power Company has closed a contract with J. W. Hornung, representing the Great Western Power Company by which the Great Western Power Company is to furnish the local company with electricity for local consumption. George W. Peltier has been elected president and it is given out that the stock had all been subscribed. Part of the electricity will be generated at the Big Meadows plant and the remainder will be generated at a steam auxiliary plant to be erected near this city.

GOLDENDALE, WASH.—N. B. Brooks, local attorney for the Northwestern Electric Company, states that the company has advertised for bids on a $100,000 dam, to be constructed on the power site on the Big Klickitat River, between this city and Lyle. The company will also install a $500,000 electric plant at that place.

PORT ANGELES, WASH.—The Olympia Power Company has awarded the contract to P. J. Woods for constructing the right of way for a transmission line from this place to Irondale. The contract comprises clearing and furnishing cedar poles at a cost of $18,000. The company will itself erect the transmission line.

NORTH COLUMBIA, CAL.—The St. Gothard Consolidated Gold Mining Company, operating the Delhi mine, is planning to put in an electric plant. The company owns a valuable water right in Bloody Run, and it is believed that enough power can be developed to operate the Delhi mine, which has been without water the present season, owing to the damaged flumes of the Northern Water & Power Company, which have heretofore supplied water to the mine. An engineer is now on the ground making the necessary surveys.

## TRANSPORTATION.

MEYERS FALLS, WASH.—The Stevens County Power & Light Company is surveying preparatory to extending its electric line to Marcus.

PORTLAND, ORE.—The Portland Railway, Light & Power Company has purchased lots in Etna addition in the vicinity of East 28th and Burnside streets as a site for a car house.

SAN BERNARDINO, CAL.—Assistant Engineer Fowler of the Pacific Electric is here with a force of eight men to take up surveys in connection with the proposed electric line extension west and southwest of San Bernardino.

SAN RAFAEL, CAL.—The Trustees have received a petition from George D. Shearer, asking that a franchise be granted him for a term of 49 years to operate an electric road over certain streets within the city limits of San Rafael.

STOCKTON, CAL.—The San Jose Electric Railway Company has commenced laying rails. Ground was broken in Modesto Friday for the 90-pound rails. There are about 1¼ miles of track to lay at Modesto.

SACRAMENTO, CAL.—Commencing next Wednesday the Central California Traction Company will tighten up its train schedule between Sacramento and Stockton, clipping 15 minutes from the schedules of all trains. Trains which now requite one hour and 55 minutes to make the run will make it in one hour and 40 minutes. Additional trains will be added to the Lodi service. Sacramento trains will make better connections at Stockton with the Santa Fe to and from Fresno and San Joaquin Valley points, at Herald with Southern Pacific trains to and from Ione, Jackson, Sutter Creek and Amador County points, and at Sacramento with the Northern Electric Railway to and from Marysville, Oroville and Chico.

OAKLAND, CAL.—The precedent established by the Oakland Traction Company several weeks ago in installing a through service of coupled cars on Twelfth street to the Key Route pier, is soon to be followed up in various portions of the city, according to an announcement made to the commis-

sioners by W. R. Alberger, vice-president of the company. Alberger states that within a few days the company will install a special service from Twelfth street and Broadway to Hayward. Coupled cars will be used, and stops will be made only at San Leandro and Elmhurst. The schedule of regular car service on the line will not be curtailed. Similar changes will be made on the Oakland Traction Company lines to Richmond and Albany, in order to regain business taken away from the local concern by the Santa Fe. Alberger states that sixty new cars have been ordered. Ten cars are expected next week and twenty have already been received.

RIVERSIDE, CAL.—Officials of the Pacific Electric Railway Company are going over the Magnolia avenue extension plan. The company is ready to build a line along Colton avenue, through Colton to San Bernardino. The company will also build from here to Los Angeles.

## TELEPHONES.

CAREY, IDAHO.—The Carey Telephone Company, capital $2100, has been incorporated by C. C. Shelter and Thos. C. Stanford.

LIVERMORE, CAL.—The Stockmen's Protective Association is making efforts to secure better communication with the mountain section southeast of here.

EVERETT, WASH.—The Cedarhome Telephone Company, capital $10,000, has been incorporated by Peter Hanson, H. Neilson, O. A. Prestrud and others.

NEVADA CITY, CAL.—The Tahoe national forest has let the contracts for constructing telephone lines in various parts of the forest. Work will commence immediately.

VANCOUVER, B. C.—It is announced that the British Columbia Telephone Company will shortly install a new cable connecting this place with Nanaimo, on Vancouver Island.

PENDLETON, ORE.—An effort will be made to have the city attorney to draw up an ordinance compelling telephone companies to install all telephone and electric light wires underground hereafter.

VENTURA, CAL.—The Pacific Telephone & Telegraph Company is about to commence construction of three additional trunk lines from Ventura to Santa Barbara and an extra line from Ventura to Oxnard.

WILLOWS, CAL.—The Pacific States Telephone & Telegraph Company is planning numerous improvements in the service here. It is declared that an expenditure of $15,000 will be required to carry out the plans.

CHELAN, WASH.—The Knapps Coulee Telephone Company has decided to proceed at once with the construction of the proposed rural telephone line through Knapps coulee. The trustees were instructed to purchase the necessary equipment.

MANILA, P. I.—The joint board on wireless telegraphy, appointed some time ago in the Philippines, has held its first meeting. It is understood that the report contains recommendations which will probably result in the early establishment of a wireless system in the islands.

NAPA, CAL.—The application of H. Voorman Du Bois for permission for the period of 20 years to build and maintain a telephone line near Napa, on the county road leading to Sonoma, has been granted. The line will be constructed under the supervision of Jasper Partrick, supervisor of West Napa township.

NAPA, CAL.—The application of W. H. Simmons and others for permission for the period of 20 years to build and maintain a telephone line near St. Helena has been granted. The work of constructing the telephone line will be under the direction of B. Bruck, supervisor of Hot Springs township.

## WATERWORKS.

GRESHAM, ORE.—The Gladstone City Council has decided to employ H. C. Kelsey, an engineer of Portland, to draw up plans and specifications for a waterworks plant to be installed by the city. The Council has decided upon an appropriation of not more than $20,000 for the work.

SAN LUIS OBISPO, CAL.—The Pine Mountain Water Company has let a contract for a 40-mile pipe line from the Cuyama to the town of Maricopa.

WILLITS, CAL.—The Board of Trustees will take immediate steps for the acquisition or construction of a municipal water system in the town of Willits.

TACOMA, WASH.—The Council has provided for the installation of a 6 inch wooden water main in East B street from South Sixty-fourth street to South Seventy-second street.

PORTLAND, ORE.—Steps towards the installation of water meters throughout the city will be taken by the mayor at a meeting of the water board. The cost is estimated at $300,000.

TOLEDA, ORE.—Jacobson-Bade Company of Portland has been awarded the contract for the construction of the water system. Six miles of pipe will be laid and the contract was awarded for $20,000.

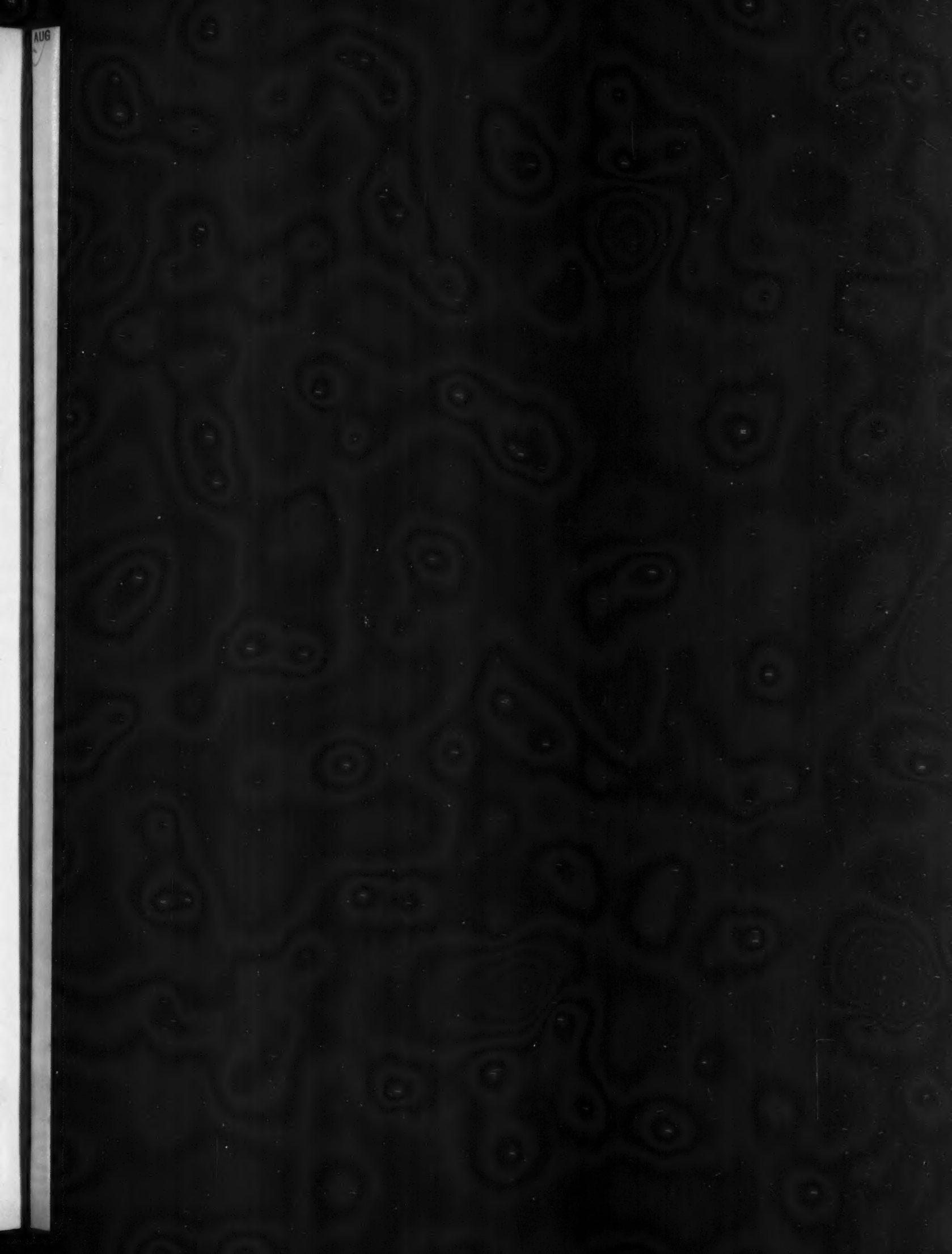
PRESCOTT, ARIZ.—Business men of the city have begun an effort to secure a better and less expensive water supply for the city. The Council has been asked to appropriate a sum for drilling an experimental well.

FRESNO, CAL.—The Supervisors have ordered the surveyor to draw plans and specifications for the erection of a 45 foot water tower at the alms house. An additional steel tank of 7000 gallons capacity will be erected.

GLADSTONE, ORE.—Louis C. Kelsey, has been employed by this place as engineer to prepare specifications and estimates for a pumping plant and water works system. An election to vote $20,000 bonds for construction will be held July 31st.

PHOENIX, ARIZ.—Application for a patent has been made for the new townsite of Superior. That mining camp is to have a water system. The lakes on Queen Creek above Superior have been located for the purpose and water will be piped to town for mining and domestic use.

ONTARIO, CAL.—The general water committee has recommended to the Council that an extension of 200 feet of 4 inch pipe be made for every customer outside of the limits of the system as planned by F. E. Trask of Los Angeles. The water system for the city is now under construction.

IRVINGTON, CAL.—Through the efforts of the chamber of commerce the fire protection system of Irvington will be improved by the installation of a 75,000 gallon water tank on the hill near the Palmdale winery. A six-inch pipe will be run from the reservoir to the water main in First street.

HAYWARD, CAL.—Sealed bids will be received by the Board of Supervisors at the clerk's office up to 10 a. m. July 24th, 1911, for the construction of a water plant on the Lake Chabot road from Castro Valley road to the County road No. 2730. Plans and specifications are on file with the clerk.